NOV 20 1922

Electrical World

McGraw-Hill Company, Inc. New York, November 18, 1922 Twenty-five Cents a Copy

The engineers who are making America's great transmission systems possible want cold facts. *Insulators are used in strings. Buy them that way—based on electrical characteristics per string.*

More insulation — less investment. Pages from the J-D brief case in following issues tell the facts.

"Tell 'em the facts"

Jeffery Dewitt

Metropolitan Reactors

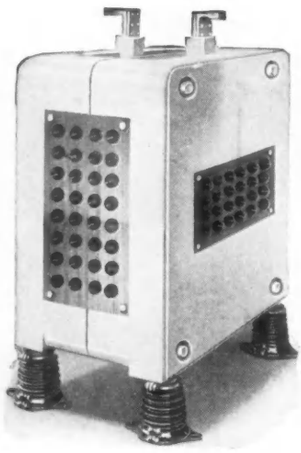
have just been ordered by the

EDISON ELECTRIC ILLUMINATING CO. BOSTON, MASS.

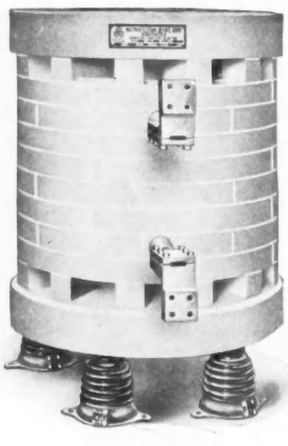
When a central station manager is in doubt as to the kind of current-limiting reactors to install—it is a good idea to check up what equipment is used by the greatest and most economical generating plants in this country.

Metropolitan Reactors, for instance, are used by the big Edison Companies in New York, Chicago, Detroit, Brooklyn, etc. Also they are standard equipment not only in the central station, but in the industrial field as well.

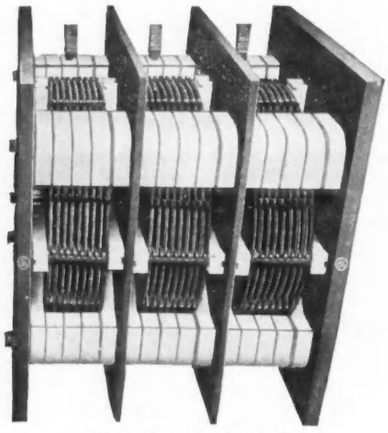
Short circuits cannot be prevented as yet, but you can do the next best thing, install Metropolitan Reactors and protect your equipment from abnormal and dangerous stresses. Just clip the coupon.



Indoor service 25 to 350 Amp.



Indoor service
350 to 750 Amp.



Three-phase Feeder Coil

Partial List of Installations of Metropolitan Reactors

Edison Elec. Illuminating Co., Boston, Mass.
Brooklyn Rapid Transit Co., Brooklyn, N. Y.
Calgary Municipal Electric Co., Calgary, Canada
Canadian Niagara Falls Power Co., Niagara Falls, Ont.
Cataluna Power Co., Barcelona, Spain
Chicago, Lake Shore & So. Bend R. R., Mich. City, Ind.
Cohoes Light & Power Corp., Cohoes, N. Y.
Commonwealth Edison Co., Chicago, Ill.
Consolidated Gas & Electric Co., Baltimore, Md.
Dayton Power & Light Co., Dayton, Ohio
East Hampton Gas Co., East Hampton, Mass.
Edison Electric Illuminating Co., Brooklyn, N. Y.
Edison Illuminating Co., Detroit, Mich.
El Paso Power & Railroad Co., El Paso, Texas
French General Electric Co., Paris, France
Hydro Electric Power Commission, Toronto, Ontario
Interborough Rapid Transit Co., New York, N. Y.
Joyce Gridland Railroad Co., London, England
Municipal Gas & Electric Co., Albany, N. Y.
New York Edison Company, New York, N. Y.
N. Y., N. H. & H. R. R. Co., West Farms, N. Y.
N. Y. & Queens Elec. Lt. & Pwr. Co., L. I. City, N. Y.
Potomac Electric Co., Washington, D. C.
Public Works Department, Lake Cooleridge, N. Z.
Public Service Electric Co., Newark, N. J.
Shawinigan Hydro El. Pwr. Co., Shawinigan Falls, Ont.
Tennessee Power Co., Chattanooga, Tenn.
Toledo R. R. & Light Co., Toledo, Ohio
Toronto Power Co., Niagara Falls, Ont.
Turners Falls Power Co., Turner Falls, Mass.
United Electric Lt. & Pwr. Co., Springfield, Mass.
United Electric Lt. & Pwr. Co., New York, N. Y.
Union Gas & Electric Co., Cincinnati, Ohio
U. S. Explosives Plant, Nitro, West Va.
Utica Gas & Electric Co., Utica, N. Y.
Victoria Falls & Transvaal P. Co., Simmerpan, S. Africa
Warren & Co., Boston, Mass.
Youngstown Sheet & Tube Co., Youngstown, Ohio

CLIP THIS COUPON

Metropolitan Device Corporation
1250 Atlantic Avenue, Brooklyn, N. Y.

Gentlemen:—Please send data and full information on current limiting reactors

Name ..... Company .....

Address ..... Title .....

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, Jr. Editor — HAROLD V. BOZELL Editor

EARL E. WHITEHORNE, Commercial Editor — ALLEN M. PERRY, Engineering Editor — L. W. W. MORROW, Associate Editor — J. C. MARTIN, Western Editor — ROBERT SIBLEY, Pacific Coast Editorial Director — H. S. KNOWLTON, New England Editor — ROBERT M. DAVIS, Statistical Editor

T. P. KINDIG, Associate Commercial Editor — H. M. CUNNINGTON, Trade and Markets Editor — R. L. SHEPHERD, Assistant Engineering Editor — H. C. ANDERSON, Assistant Western Editor — PAUL WOOTON, Washington Representative — F. C. WELLS, Associate News Editor

Volume 80 — New York, Saturday, November 18, 1922 — *Number* 21

Where the Central Station Stands

WE TALK of the central station —we of the electrical industry— and what it should and should not do. We discuss its functions, its obligations, its opportunities, its methods, its achievements, its mistakes. But seldom do we stop to think of what it has become today, its place in this great working world.

Yet it is well sometimes to stand away off and scrutinize such a familiar thing. For out of it will often come new understanding of relations and responsibilities that have been indistinct amid the clutter of our busy-ness.

What *is* the central station, then? Where does it stand today in this electrical industry of ours and in the nation?

THE central station is the great heart that pumps life blood continuously to every electrical man in all communities. It is a vital factor in the work of every dealer, contractor, jobber and manufacturer. Stop the central station and you stop all— the manufacturer would find his market gone, the jobber's trade would become paralyzed, the contractor would wire no buildings, the dealer would sell no appliances. For each one is dependent upon the central station to provide the energy to vitalize and sustain his business life. Without central-station service the lamp, the motor, the heating appliance is valueless to the general public, and there would be no electrical industry.

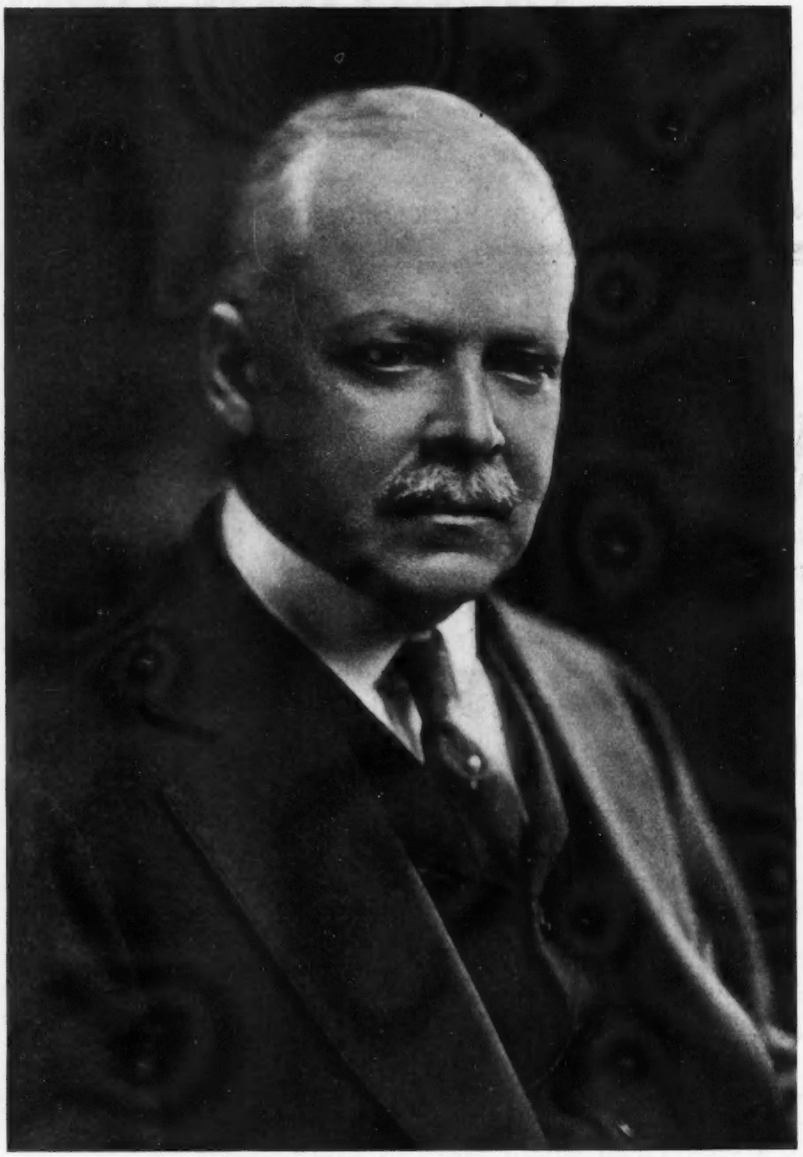
To the public the central station has become indispensable. In the modern community we rely upon electric light, not alone for comfort and for health in streets, homes, stores, offices and factories, but to reduce the risks of fire, accidents and crime. We rely upon electric power to provide street transportation and elevator service, to save labor and to supply the facilities for production that make the modern industrial concentration possible. In our homes we depend upon electricity to lighten housework and contribute all kinds of comforts that have come to mean much in human happiness.

Electric service has woven its pleasing pattern into the very fabric of our lives. It has brought us more health, more peace, more ease, more play. And so the central station has become essential to the maintenance and improvement of our very standards of living and to the growth and prosperity of every modern community. For deny electric service to any city and how many of its people would remain?

THE central station has inspired the building of an industry and with the opportunity has assumed the obligation. It has guaranteed a fundamental service to its industry as well as to its public. Its policies cannot just serve itself. They must be fair and helpful to all other electrical men of every class, both locally and nationally. And the growth and greatness of the electrical world today are a measure of how well this service has been rendered.

Henry Morrell Atkinson

A public utility executive and banker who helped build the electrical industry in the South.



BACK of every electrical development there are men with legal and financial training who have the courage to place money at the disposal of engineers and the vision to build with the future properly weighed and judged. H. M. Atkinson has had financial affiliations and experiences as a utility executive which have placed him among the leaders of the South and have enabled him, as chairman of the board of directors of the Georgia Railway & Power Company, to develop successfully large utility systems for supplying light, power and transportation to Atlanta and vicinity.

Born at Brookline, Mass., on Nov. 13, 1862, he was educated at private schools in Boston and was graduated from Harvard in 1884 with the degree of A.B. In September, 1886, he went to Atlanta, where, after a short experience with the cotton industry, he entered the banking business. He rapidly forged to the front as a banker and was active in the reorganization and consolidation of several Atlanta banking institutions. He served as president and vice-president of banks until 1910, when he resigned as vice-president of the Third National Bank to devote his entire attention to his other duties.

Mr. Atkinson has been identified with nearly all the important electrical projects that have been put through in Atlanta for twenty-five years and has contributed much to the city's growth and prosperity. He organized and built the first electric lighting system in Atlanta and was the first president of the Georgia Electric Light Company. With others, he consolidated the City Railways & Lighting Companies of Atlanta into the Georgia Railway & Electric Company. He also organized the Georgia Railway & Power Company. This company, which subsequently leased the Georgia Railway & Electric Company, has made, and is continuing to make, extensive water-power developments in Georgia and is now doing the entire street-railway, electric lighting and gas business in Atlanta, as well as a large hydro-electric power business throughout the northern part of the state forming an important link in the Southern system.

Mr. Atkinson organized, built and was the first president of the Atlanta, Birmingham & Atlantic Railroad, which has contributed immensely to the development and commercial prosperity of those sections of Georgia and Alabama served by it. In his social and commercial affiliations and in his ideals of service he is well established as a leader, one in whom the Atlanta district and the electrical industry take great pride.

Editorial Comment

Electrical World, November 18, 1922

Volume 80 Number 21

California Defeats Water-Power Act

CALIFORNIA is still listed among the forty-eight states of the Union. Election day is over; the sober judgment of its voters has been passed on the water and power act, and it is overwhelmingly defeated. Whatever apprehension might have been felt about the sanity and steadfastness of California in such a crisis, the result shows it to have been unwarranted. California chose to remain solvent. All the appeals to prejudice, passion and self-interest have affected her not at all. They have not been able to warp her judgment or lure her from the paths of righteousness. The issue was not one primarily between power companies and the state. It was more vital than that. It involved the sanctity of covenants and the honor of the commonwealth. That her voters chose to recognize such obligations speaks volumes for California.

At the same time, we hope that the electric public utilities of California will emerge from this attack with a humble and grateful spirit of dedication to the principles of service and to the furtherance of harmony and friendliness. Not that these have been ignored—quite the contrary. The vote, however, shows that there are still tens of thousands in California who need conviction on the issues involved. To win over this opposition is the task that now confronts the utilities. California's public utilities can have but few interests not shared by the state and its people. Therefore, if the utilities seek to gain good will they must convey it. If they are to harmonize conflicting opinions, they must breathe the spirit of harmony and exhibit a willingness to let bygones be bygones.

The support given the utilities was magnanimous. It was a wonderful tribute to their efficiency and standing in the state. It shows that the public is not ungrateful. On their part the utilities should not be unmindful of this tribute, and by their future actions they should convince the public that it was not undeserved.

Italy Discards Government Ownership

THE fallacies and weaknesses inherent in popular forms of social philosophy are not always immediately discernible or provable. Time is necessary to reveal their shortcomings and defects, and the largest service of history is that it teaches by experience. We have always held that our system of private ownership and operation under public regulation is the logical way of conducting the business of public utilities and the best that can be devised. When, therefore, we encounter confirmations of this fact in unexpected ways and places they seem to us "proofs strong as Holy Writ."

One would hardly expect even a regenerated socialist to be impenetrably prejudiced in favor of private and against public ownership, yet we find the recognized head of the Fascisti of Italy, Premier Mussolini, pronouncing most emphatically against the latter. Delving into the economic situation in that country, he encountered vast deficits and immediately set about to stop the leaks. One-third of these losses were attributable to the state-owned public utilities, and almost overnight Mussolini determined to rid the government of those utilities whose earnings and services were such as to make them obnoxious both to the owner and the user. As a result the state-owned telephone system and a large part of the government railroads of Italy will soon be operated by private enterprise, thus eliminating from the budget many of the items which went to make up the deficit. The details available are much too meager to justify more extended comment, but they are sufficient to indicate that the mills of the gods are grinding.

Public Purchases Bonds in Small Denominations

THE bond of small denomination has become a popular issue. This may have been brought about by the Liberty loan campaigns, but a very decided influence has been the customer ownership campaigns of electric utilities. A compilation made by Dow, Jones & Company of issues for more than a million dollars in bonds of one-hundred-dollar value shows that of the 160 companies listed the electric and telephone companies number 123. A cause for congratulation lies in the compilation of the *Wall Street Journal* showing comparative average prices for several classes of bonds. The average price of the public utility bond is next highest to that of the industrial bond and has made the greatest increase in the past year.

Electrical utilities as a rule prefer to issue secondary securities, but frequently there is a necessity to issue bonds to obtain adequate capital at favorable rates.

Most utility executives are favorably disposed toward the issue of bonds of small denominations to secure needed money, and the banks and bond houses also find the small bond profitable. Utility financing is now at its height, and in this connection recent remarks of Samuel Insull are significant of the trend of thought. He favors making mortgages cover the widest possible ground and making provisions for issuing bonds under them at varying rates of interest and in various denominations so as to assure maximum flexibility in marketing. In his opinion the best form of public utility bond is similar to the "debenture" type which has been widely used in England.

These changes in financial methods and thought are encouraging signs of health, and in their development the electric utilities are in the forefront in the magnitude and diversity of their operations.

Electric Furnace Comes Into Its Own

A SLOW recognition of the merits of the electric furnace in the steel industry was to have been expected, because changes of magnitude in methods or equipment in such a large industry occur slowly. But that this recognition now exists is made clear in this issue by the president of a steel company, who lauds the furnace as the agency that has enabled that industry to meet new demands for better quality in its products.

The great advantage of the electric furnace is not necessarily in low cost of production, but in its flexibility for many uses and its ability to make high-grade steel of uniform quality. For melting, refining and casting iron or steel the furnace has a field, and it speaks well for the initiative of American engineers to find that the United States leads the world in the number of installations.

This splendid condition already exists, but there are many possibilities for a greater use of the furnace. It is particularly well suited for foundry purposes because it produces an equally good product in the large and the small sizes. Central-station companies may well help introduce the furnace to the foundrymen, because it results in a splendid load on the system and may be adapted to valley conditions. The automatic regulating equipment has eliminated the features of older installations which were bad from the load standpoint.

Increasing Service Reliability

HEAVIER loads upon central stations and increasing investment in plants and lines give new force today to the definition of "service" accepted by the progressive public utility managers concerned with the production and distribution of electrical energy. The public relations aspect of poor service is of tremendous importance. Hence it is not surprising that the study of system layouts, station development and the retirement of less modern equipment, the organization of more "shipshape" means of handling service and the analysis of load curves, log sheets and operating reports should be uppermost in the minds of central-station managers as a more or less continuous problem.

A broad view of the question of obtaining more reliable service is given on another page by Fred D. Gordon. From this article one becomes increasingly aware of the number of factors which enter into the operation of a central station's usefulness to its community. The economic problem of getting the most out of the equipment at the lowest cost consistent with good service is always present. Where the system combines the outputs of hydro-electric and steam plants, the stage is always set for first-class engineering in the operation of such a property. The author's diversified experience adds not a little to the weight of his views, for the Maine companies with which he has been associated have illustrated in a very striking way a successful solution of the problem of providing good service under varied conditions of water supply, varied proportion of steam auxiliaries justified, transitions in station and equipment design, and a market with extremely divergent uses of service.

Two points in Mr. Gordon's opinions may well be elaborated by the operating reader for himself—the need of getting rid of obsolescent machinery and apparatus and the importance of giving regular executive attention to daily log sheets and reports of operation. We need not stress these points in detail, but among the sins of commission and omission which darken the shield of the well-intentioned but preoccupied manager these two stand out in small or medium-sized companies in altogether too prominent emphasis. It is human nature to get along with a machine or a device as long as it will function and to pigeonhole routine reports from stations, but alert and progressive operating executives do not build or maintain their reputations in this way. Courage and industry applied with insight and vigor to these two matters will reap their reward in the service record.

Oregon Commission Establishes a Bad Precedent

IN WRITING a ratio of investment cost to annual revenue into a set of rural service rules as a basis on which utilities must make investments in service-line equipment the Public Service Commission of Oregon has set a bad precedent. To begin with, the rules are confusing. One rule dealing with increases in line capacity due to increases of load is so framed that it at first appears as if the utility were required to finance the entire cost, and the requirement is then modified in such a way that it appears as if the utility could collect a sufficient sum from existing consumers on the lines to bring its investment in the district affected to a basis of two dollars of investment to one of revenue. The exact interpretation of the rule is a matter of doubt in several ways. The effect of consumer investments is also doubtful. Later, in dealing with the actual extensions, the utility is required to invest four dollars for every dollar of minimum or guaranteed revenue. It is thus difficult to determine just what is meant, but regardless of the ratio figure used, it does not appear that any figure can be adjusted so that conditions on all the utility's properties even in one state can be met and the resulting practices be non-discriminatory.

Costs of rural service from the power house to the consumer are difficult to obtain because little attempt has been made anywhere to get complete and accurate figures. Taking the study based on the conditions of an Iowa company which appeared in the September 23 issue of the *Electrical World* and reducing the figures in Tables I and XI (pages 656 and 658) to the cost and revenue per mile shows that for one to three customers (a fair average per mile for American rural systems) the cost of lines ranges from $1,064 to $1,392 per mile. The utility must receive from the consumers $250 to $393 per mile to cover all service costs from the power house to the consumer—or, roughly, 23 to 28 per cent of the investment in line equipment for the consumer's use—before any charges for energy are made. In other words, the indications are that for a varying number of consumers per mile the ratio must be higher for the larger number because there are certain expenses, such as consumer, transformer and meter costs, that vary directly with the number of consumers. The actual line investment costs for the comparatively small number of customers available remain stationary, and the actual costs of service for the group become a bigger percentage of the investment cost.

This use of the Iowa figures probably does not express Oregon conditions in an extremely accurate man-

ner, but it does indicate a condition which should give pause to other commissions that may be inclined to copy the Oregon method. Short-cut methods that look inviting and are apparently easy to administer are usually dangerous, and in this case the Oregon commission may find that it has put itself in the position of forcing the utilities of the state to do what it recently decided the Mollala Electric Company must pay a penalty for doing—overbuild in sparsely settled territory.

Use of CO_2 as Fire Extinguisher Offers Advantages

THE adoption by many central-station companies of the inclosed system of ventilation for large generators offered opportunity for the use of new methods for extinguishing generator fires. The system at Hartford described in this issue by T. H. Soren affords additional evidence that the use of CO_2 is efficacious and comparatively cheap. The great advantage of the system is that service can be maintained for some minutes in the event of generator trouble without having it spread to all parts of the winding. This gives the operators time to make an investigation or to shift the load gradually. Another advantage is the elimination of steam or water fire-prevention systems which in themselves introduce insulation hazards by their proximity to the winding.

The cost of the gas is not great and the system marks a distinct advance in practice. Actual experiences with fires under operating conditions are yet needed to tell the whole story. It is to be hoped that this method will solve the problem that has led to its trial, for the speed with which destructive fires accomplish their work once they get a start in turbo-units operating at the usual peripheral velocities leaves little or no time to organize men and apparatus to fight them.

Insure Against Lost Opportunity

THERE are two reasons why so many central-station companies neglect to establish competent sales departments. First, they look upon this department as an expense and only as an expense. They hesitate to hire a good sales manager and, in the larger companies, to give him a good staff, because much money would have to be paid out in salaries. Second, the executives themselves not being salesmen fail to visualize the opportunity and the way to grasp it. They fail to see that a *good* sales department pays all its own expenses plus a profit and that a *good* sales manager himself knows how to get business and generate his own ideas. He is not a burden on anybody.

It took a long while to teach the public the value of insurance, but today the principle of insurance is pretty well established as regards life, fire, accident and casualty policies of various kinds. Every central-station executive thoroughly believes in it and protects himself in this effective way. But, after all, a sales department is only a further application of the same sort of sound common sense. It insures a volume business. It insures growth. It insures an additional source of income from merchandise sales and an opportunity to select the class of business which is most profitable to develop. Without an effective sales department a central station is commercially drifting. With a competent sales force it shapes its own future.

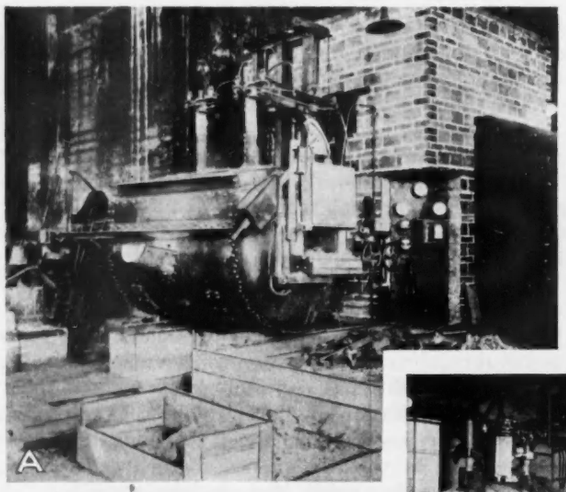
Some of the Problems of Flicker Photometry

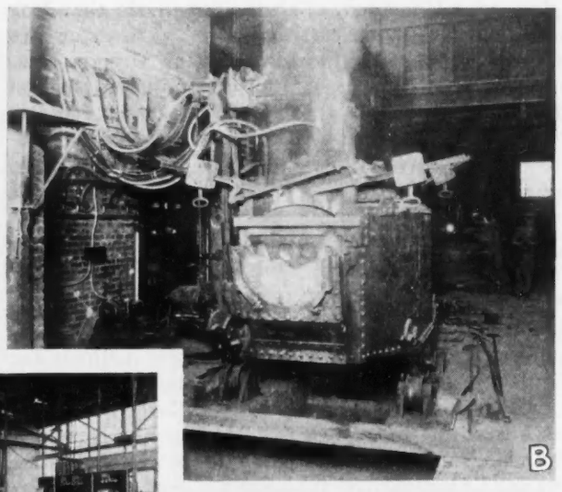
WE HAVE learned to look to Ferree and Rand for highly ingenious experimenting and interesting results. The paper prepared by them for the convention of the Illuminating Engineering Society deals with the often-discussed matter of flicker photometry. Of course, it is well known that in the comparison of lights of different colors the flicker instrument gives results materially different from the equality-of-brightness photometer. It is generally regarded, too, as more reliable, but where a discrepancy exists and there is no available method to ascertain with absolute precision the cause of the variation, it is always worth investigating. In the case of flicker photometry the research is fraught with almost every conceivable kind of difficulty, because little is definitely known about the relation of the sensation of flicker to the color stimuli that reach the retina and the speed at which they are developed. It is this last-named factor with which the paper before us deals; that is, the growth of color sensation as a function of time in the transient sensation obtained in the use of a flicker photometer. The study made in the paper under notice bears definitely on the rate of growth with time of the sensations of color. This rate of growth proves to vary greatly, like all similar functions, in different persons and different states of adaptation in the same individual.

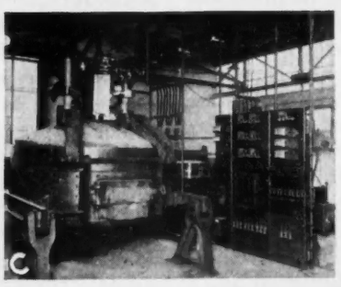
So far as Ferree and Rand's investigation goes, it does not deal yet with a sufficient group of observers to allow a safe average to be taken, nor does it make altogether clear the particular state of adaptation reached during the experiments. It does, however, bring out very clearly that there is a somewhat large factor of uncertainty in flicker due to the variations in the relatively slow rise of sensation for the several colors. What is perhaps the most striking result of this very interesting investigation is that it was found that, using the flicker photometer on the one hand and the equality-of-brightness photometer as the "blink" instrument on the other, the results dropped into coincidences. In other words, taking the variations of sensation in the flicker method as they were found, glimpsing the equality-of-brightness field for the same observing time led to the same result as in the case of the flicker. A large element of uncertainty appears, then, to be introduced by the use of the brief exposures of the flicker disk as against the steady stimulus of the ordinary equality-of-brightness method.

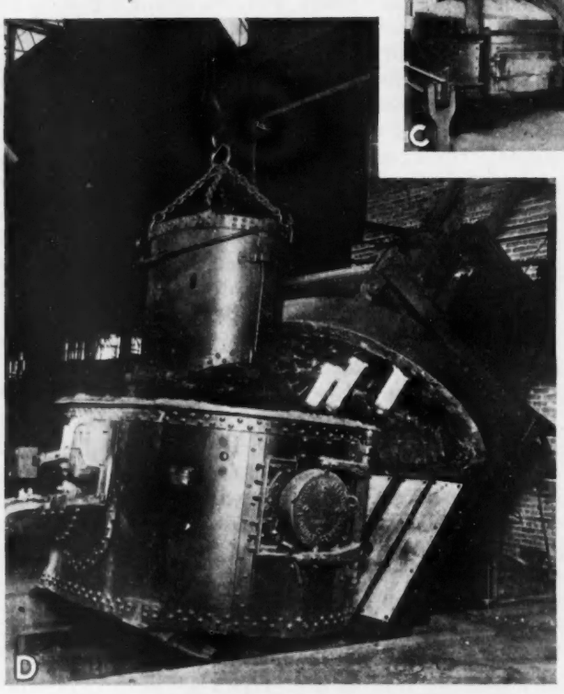
It should here be noted that a flicker photometer of the Simmance-Abady type gives a very different character of exposure as regards its time relations from the instrument used in the experiments here described. This may indicate the reason why the photometer performs a good deal more steadily than these very experiments appear to show. The improved relation between the two general methods obtained with very short exposures in the equality-of-brightness comparison suggests an interesting side line of research on the effect of such brief exposures on simultaneous contrast of colors, which is known to be one of the troublesome factors in photometry of colored lights. We trust that by next season's convention the authors of this painstaking study will have had opportunity to try out this and many other collateral experiments which naturally suggest themselves. It is good team work to co-operate in this kind of research.

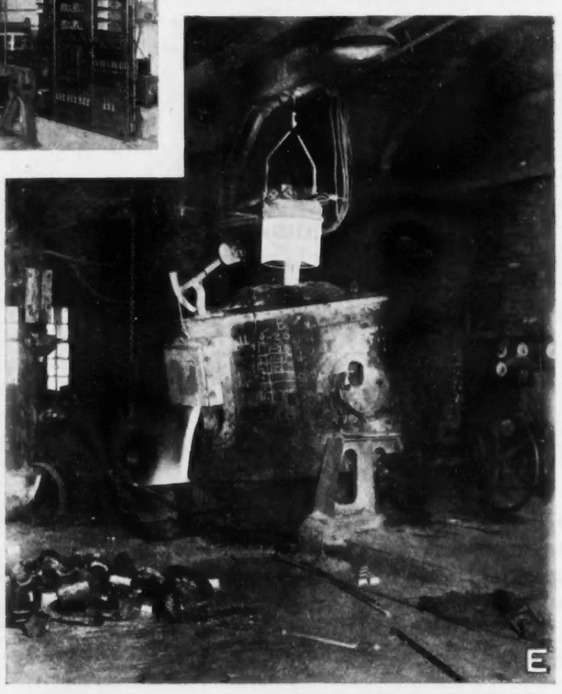
Electric Furnaces Produce Quality Steel

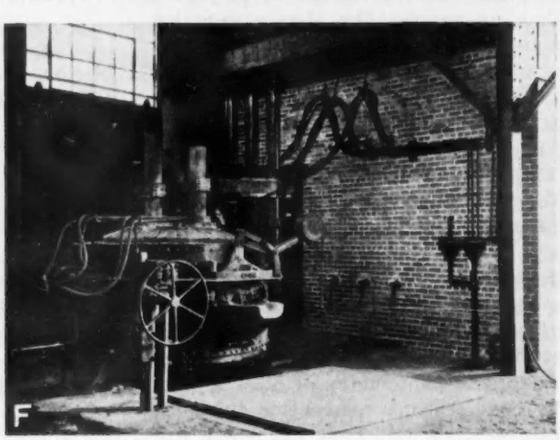

A

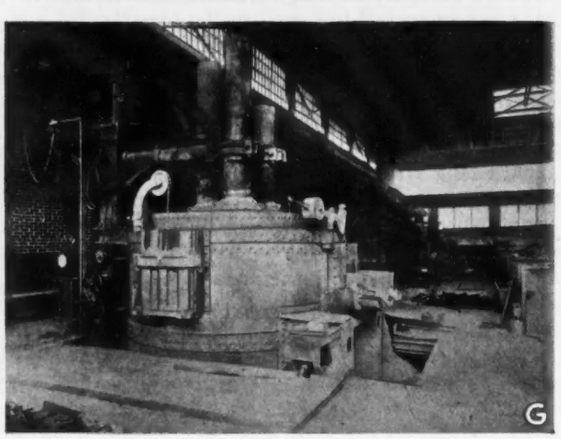

B


C


D


E


F


G

The drastic specifications for steel materials have offered opportunity for the electric furnace in the industry. Various types of furnaces are available and a great development has occurred in the control and regulating equipment so that these furnaces now afford a splendid load for central stations which is growing rapidly.

Extinguishing Generator Fires with CO_2

Marked Success Obtained in Hartford Tests—Ten per Cent Concentration Found Not to Support Combustion—Can Be Established Four Seconds After Detection of Fire and Maintained Sufficiently Long

By T. H. SOREN
Vice-President Hartford Electric Light Company

CARBON dioxide promises marked success as a means of stifling turbo-generator fires, according to recent tests made at the South Meadow station of the Hartford (Conn.) Electric Light Company. Measurements of the percentage of CO_2 retained in the casing at various periods after admission under pressure show that the conflagration hazard may be regarded as nil if prompt action is taken by the operating force, and that several minutes may be utilized in investigating the causes of apparent difficulties or threatened troubles before it becomes necessary to close the turbine throttle and shut off the water of the air-cooling system. These results are achieved by relatively simple means—means arrived at, however, after experiments lasting through many months.

The South Meadow station has one 20,000-kw. General Electric generator installed at present, the foundations being prepared for a second unit of the same size. When the plant was designed the General Electric Company recommended the installation of the inclosed system of air cooling, and as experience elsewhere and local conditions were favorable, this was done. Fig. 1 is a diagram of the ventilation system, showing the arrangement of apparatus for admitting CO_2 to the generator casing in emergencies, a general view of the equipment being shown in Fig. 3.

The air is taken in at each end of the generator and discharged through the center. The air, therefore, comes down between two partitions and up through the air washer and eliminators. Doors are provided which are geared together so that, if necessary, the system can be operated as an ordinary open system by opening vertical doors on each side of the intake and one side of the discharge and, at the same time, closing a door horizontally to prevent recirculation. The air is then drawn in at the lower part of the chamber through the air washer and discharged toward the boiler room at the upper side of the foundation. The discharge is through a duct equipped with doors, so that the warm air can be diverted for use either in the turbine room or under the draft fans in the ash room.

For generator fire protection the manufacturers recommended and furnished with the generator a sprinkler system around the end connections for the use of either steam or water. This seemed undesirable, and, owing to the fact that the inclosed system proved satisfactory and reliable, it seemed best to control generator fires by an inert gas in place of steam or water. The latter system was therefore installed.

The apparatus centers in a tank at the condenser floor level, about 3½ ft. in diameter by 16 ft. long, filled with gas at 200 lb. pressure. This gives approximately 2,000 cu.ft. of gas at atmospheric pressure. The whole inclosed system has a content of about 3,300 cu.ft. of free air, and the air is recirculated at the rate of 55,000 cu.ft. per minute. Therefore the maximum possible proportion of gas is about 40 per cent. From this tank is taken a vertical riser, at the top of which is a tee, with a device, shown in Fig. 2 and described below, for releasing the gas. The pipe then runs along the generator foundations, where the gas is discharged through a 3-in. pipe and a 1-in. nozzle directly under the air intake at each end of the generator. In order to detect fire in the generator, a 3-in. pipe has been inserted through the casing of the air chamber at each end of the armature winding. Weighted dampers have been placed under these pipes, which are held open by

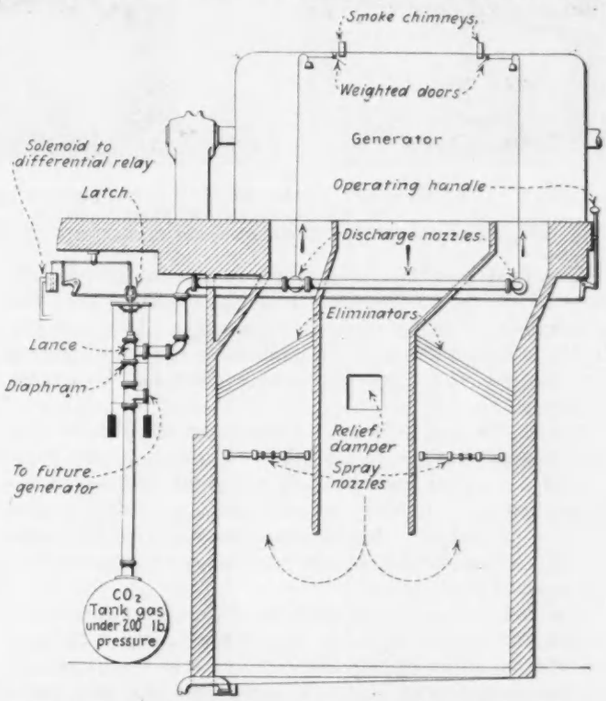
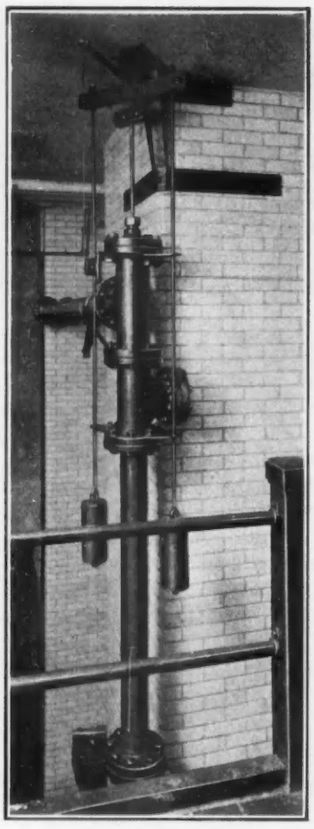


FIG. 1—CO_2 IS INSTANTLY ADMITTED TO GENERATOR CASING WHEN DIAPHRAGM VALVE IS PUNCTURED

a cable running back to the device for releasing the gas. When the gas is released, these dampers close automatically. The water from the spray nozzles is drawn off at the bottom through a trap. This was found necessary because considerable gas was entrained with the water running to waste.

As the generator lagging is reasonably tight, no change was made from the manufacturer's standard design. The openings in the foundation walls originally intended for the change from open to closed system were closed up with steel doors clamped tightly in place. In one of these doors there is a weighted damper for relieving the pressure when the gas is released from the tank.



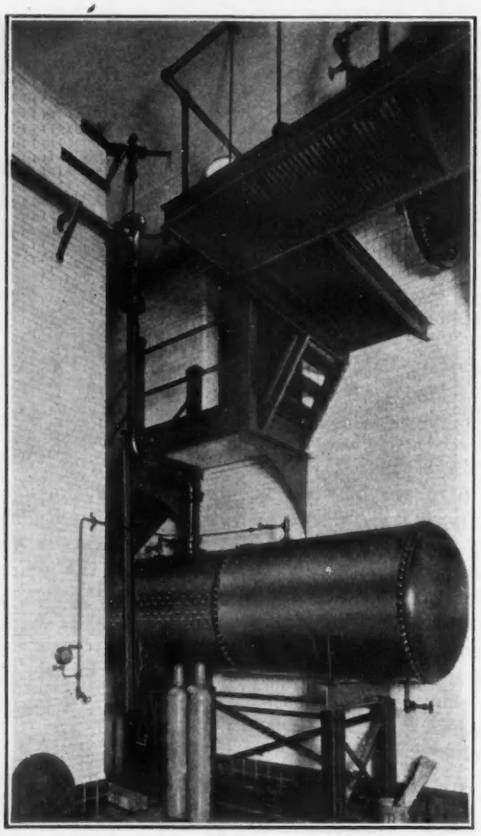


FIG. 2 (AT LEFT)—COPPER DIAPHRAGM IN UPPER SECTION OF PIPING PIERCED BY WEIGHTED LANCE TO RELEASE CO_2

FIG. 3 (AT RIGHT)—CO_2 TANK AND PIPING OCCUPY LITTLE USEFUL SPACE

The first essential is prompt release of the gas in case of suspected fire, but it is not expected that the gas will have to be released frequently. As a valve is liable to leak and require considerable time for opening and closing, the following arrangement has been substituted:

Under the tee in the riser from the tank there is a thin copper diaphragm and above it a spearhead (Figs. 2 and 4). This spearhead is weighted and when released passes completely through the copper diaphragm. In case of suspected fire the spearhead is released from an operating handle on the turbine floor immediately adjacent to the turbine.

The generator is protected by differential relays between the neutral and the generator switch. In case of internal short circuit these relays trip the generator switch automatically. At the same time that the relays operate on the generator switch they also release the spearhead, so that the air chamber is immediately flooded with CO_2.

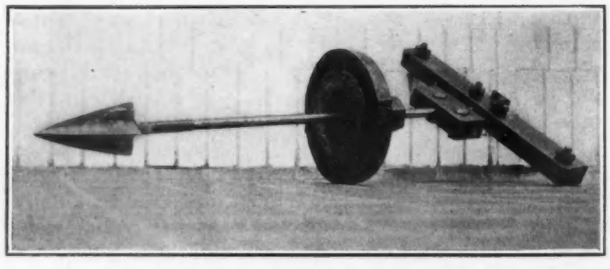


FIG. 4—SPEARHEAD FOR PUNCTURING COPPER DIAPHRAGM TO RELEASE CO_2

The object of the scheme is to release the gas immediately on suspicion of fire, giving the operator time to investigate the condition of the machine without interrupting service. With water or steam it would be necessary to take the load off the generator and open the field. With the scheme described it is only necessary to release the gas. Curve *D* in Fig. 5 shows the rate of discharge of the gas in the first two minutes.

Through the courtesy of the General Electric Company, tests were made in its research laboratory which indicate that air diluted with 10 per cent inert gas will not support combustion. Therefore the first rush of gas into the system should snuff out any flame and prevent its breaking out again while there is not less than 10 per cent gas.

Tests were made under different conditions, but none were made with the fire inside the air chamber. This naturally would decrease the amount of free oxygen. Several tests were made without turning off the water in the air chamber. All tests for percentage of gas were made by taking samples from the discharge side of the generator, as shown in Fig. 6. The gas is taken off in gas bags and tested in an Orsat apparatus, a check being made by testing for oxygen. CO_2 gas was used in all tests but one, as it was the cheapest and most available. The cost per charge was $25. One test was made with nitrogen, as shown in curve *C* (Fig. 5). The cost of a charge of nitrogen is

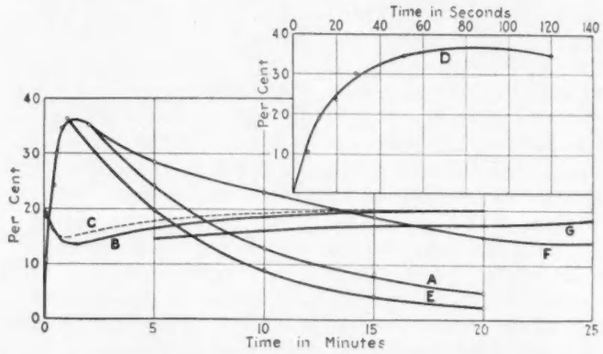


FIG. 5—CONCENTRATION AND DURATION OF CO_2 OBTAINED IN GENERATOR VENTILATING SYSTEM

The results of the CO_2 tests at Hartford are shown in the above diagram. Research laboratory tests show that air diluted with 10 per cent inert gas will not support combustion. In the diagram curve *A* shows the percentage of CO_2 with the generator operating at full speed with cooling water shut off. The non-combustion percentage was not diminished for about twelve and a half minutes after gas admission. Curve *B* shows the percentage of oxygen corresponding to curve *A*. Curve *C* shows the percentage of oxygen at various periods when using nitrogen instead of CO_2, the generator being run at full speed and the cooling water supplied at full head. In curve *D* the percentage of CO_2 measured during the first two minutes is shown, the maximum being about 37 per cent, attained in about eighty seconds. It will be noted that the non-combustion percentage of 10 per cent was attained in about four seconds after the puncturing of the diaphragm valve. Curve *E* shows the percentage of CO_2 measured with the generator at full speed and with cooling water running at full load. Curve *F* shows the percentage of CO_2 with the generator and cooling water shut off about the same time the CO_2 was released. Curve *G* shows the oxygen corresponding to curve *F*.

about $50. Nitrogen is not so easily obtained, requires more tanks to charge the main tank and is not quite as efficient as CO_2.

The test condition shown in either curve *A* or curve *E* (Fig. 5) will allow the operator several minutes to investigate conditions before shutting off the water and closing the throttle on the turbine, and still retain a sufficient percentage of CO_2 to prevent general conflagration. In case of a serious short circuit the generator field is opened and the gas released automatically. The operator then trips the throttle valve and shuts off the water. Curves *F* and *G* show CO_2 and oxygen curves under this condition from tests.

After the machine came to rest, in about twenty minutes, the proportion of CO_2 remained for some time practically constant at above 13 per cent. It would therefore appear that the system as installed can be

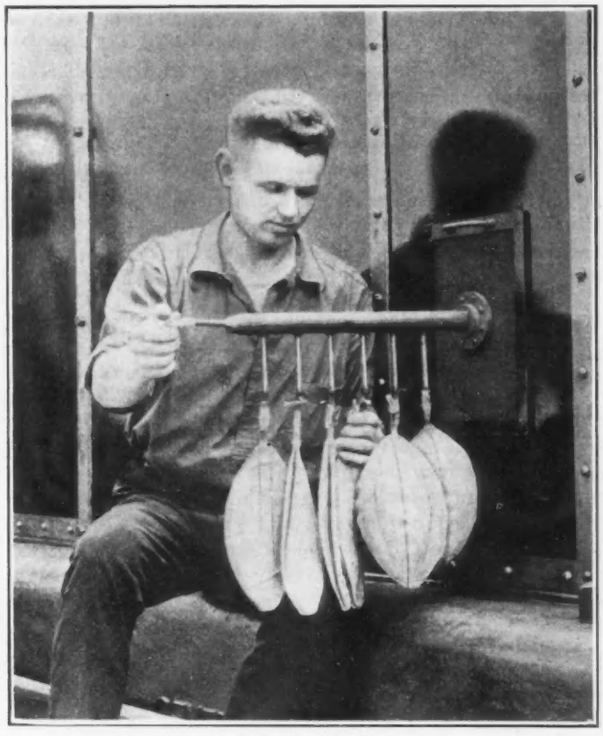


FIG. 6—TAKING GAS SAMPLES FROM GENERATOR HOUSING TO ASCERTAIN CONCENTRATION OF CO_2 AND DURATION

counted on to prevent the spread of fire from one set of coils to the next set under the worst possible conditions.

The system as laid out is intended to take care of more than one generator. With additional generators it might be advisable to install a second smaller tank with gas between 300 lb. and 400 lb. pressure that could be released into the larger tank and so continue to feed CO_2 to the system or, in case of a second fire, into the second generator.

The process of charging the large tank from the high-pressure tanks as purchased is a long one, requiring two or three hours. The tanks purchased contain liquid CO_2, and to release this into the main tank requires a water jacket heated by a steam jet.

The writer is indebted to A. R. Smith of the General Electric Company, Schenectady, N. Y., for his assistance in working out many of the problems of this system.

Electric Furnaces Lauded

Said by Steel Company Executive to Have Fulfilled Almost Every Expectation—Extremely Practicable and Adaptable for Quality Products

POINTING out that "the electric furnace was opportunely invented to meet a new demand rather than to replace an old process," John A. Mathews, president of the Crucible Steel Company of America, went on to say, in an address delivered at the meeting of the American Iron and Steel Institute at New York on Oct. 27, that "its astonishing flexibility has attracted the attention of the metallurgical world in almost every branch of smelting, refining, heating and even baking metals. It seemed very slow in achieving the recognition that we felt must inevitably come to it, but at last its products have fulfilled almost every expectation in every field wherein it has been thoroughly tried. The present success is due not only to the original inventors, but also to the active co-operation of the great manufacturers of electrical equipment, furnace designers and builders, makers of refractories and electrodes and a group of earnest metallurgists. When users acquire a full appreciation of what clean, sound steel means in terms of national efficiency, safety and economy, we shall see more rapid growth than has as yet been seen. Its usefulness to engineering and industries has just begun.

"There are now nearly a thousand electric furnaces in America and Europe, not quite half of them in the United States and Canada. [There are 388 in the United States with a productive capacity of 1,500,000 tons.] Italy has about 180 electric furnaces for steel melting, twenty-seven of which have from 15 tons to 25 tons capacity. In 1921 her tonnage of electric steel was second only to that of the United States and reached a new high mark for that country. The annual productive capacity there is about 1,000,000 tons. Some of these furnaces were operating at unusually high speed and with great economy of electrode consumption, as low as 6½ lb. per ton for cold melting. For installed capacity Italy ranks ahead of Germany, England and France and second only to the United States.

"There are sixty-five furnaces in Germany engaged in the manufacture of ingots," Mr. Mathews said, "with a yearly productive capacity of 430,000 tons and an unknown number of furnaces making steel castings with a capacity estimated at 300,000 tons per annum. We may estimate the total number of electric furnaces in Germany as about 100 to 110.

"In Sweden, Norway and Italy, where metallurgical fuel is very dear and electricity is cheap, electric smelting of ores is an established industry. The world's production for 1921 is placed at 377,900 tons, although the year 1921 was not a year of high records."

The reasons for the world-wide expansion of electric steel making are three in number, according to Mr. Mathews. These reasons he gave thus:

1. *Cheapening of wholesale power rates.* This is due to hydro-electric and improved steam-plant developments.

2. *Extreme flexibility and adaptability.* Electric furnaces have a wide range of uses. They may be successfully used for melting cold charges or refining liquid charges, for making ingots or castings and for melting ferro-alloys. They may be used alone or in conjunction with the Bessemer or the open-hearth process, or with both. They may be operated acid or basic. They may be used in conjunction

with the blast furnace or cupola for making gray iron, malleable and semi-steel castings. For foundry use particularly the small units are advantageous for making frequent small heats of steel or iron castings. All of the manifold methods of operation are possible with arc furnaces, which are by far the most frequently used here and abroad. (Of the different types of arc furnaces in the United States nearly one-half are of the Heroult type, and considerably more than one-half the productive capacity is represented by them.)

3. *Quality of products.* The cost of electric steel is rarely lower than open-hearth and never lower than Bessemer, and therefore its success is presumably due to its producing a generally superior product. Of course, there are especially favored localities or peculiar market conditions which warrant the installation of small electric furnaces where open-hearth and Bessemer installations would be out of the question. Where electric furnaces operate successfully alongside of large-tonnage fuel-fired furnaces, quality must be the principal reason for success rather than low cost.

"Quality depends upon the selection of raw materials, the process of melting and subsequent care in forging and heat treating," Mr. Mathews went on to say. "The electric furnace provides a reducing atmosphere in which sulphur is readily removed, and with it goes one of the generally recognized inclusions, manganese sulphide. The same condition serves to eliminate oxides. By way of illustrating the freedom from inclusions in electric steel, I might mention," said Mr. Mathews, "the result of the actual count of hairlines, due to inclusions, in the ground surface of chrome nickel steel made with the same chemical specifications by the basic and acid open-hearth and basic electric processes. The average count ran in the ratio of eight to four to one, and the hairlines in the electric steel were much shorter than in the steel of the open-hearth manufacture.

"The recent paper by W. J. Priestley* outlines the splendid results of electric furnace ordnance steels made at Charleston, W. Va., in the largest furnaces in the United States. He shows that the results are due to clean steel and freedom from oxides, sulphur and phosphorus. These results show that large units with proper handling can produce very high-quality steel, and we can see no reason, now that larger electrodes can be made of dependable quality, why 60-ton or 80-ton furnaces cannot be expected to give relatively satisfactory results."

Commenting on electric furnace developments, Mr. Mathews declared that no new principles of heating have been employed since the first few years of development, with the possible exception of the high-frequency induction furnace. Of mechanical and electrical refinements there have been many, all in the nature of improvements in regulation and economy. Among these may be mentioned two of American origin, the automatic electrode regulator and the peak-load regulator. "The desirability of relatively high voltage for melting and low voltage for refining is now generally recognized," he continued. "Many improvements have been made as the shortcomings of the earlier furnaces appeared, such as well-fitting doors, water-cooled arches, better electrodes and holders, and economizers to cut down oxidation and waste of the electrode. In my own experience," said Mr. Mathews, "I have seen electrode costs per ton of product as high as $8 gradually decline to 35 cents. This was in a furnace refining molten charges."

During the years 1917 and 1918, when electric steel furnaces were installed in great numbers, the fear was expressed that furnaces would be built faster than skilled operators could be trained. At that time "fears were justified, for much electric furnace product was not what it should have been," declared Mr. Mathews, who pointed out that he has "always discouraged the idea that the electric furnace was a foolproof and automatic process for making superior steel by those unskilled in steel making.

"The most popular size of electric furnace in this country is of a gross capacity of 6 tons," he said, "but furnaces of from 0.5 ton to 40 tons capacity have proved equally successful. In furnaces of 6 tons or a little larger hand charging is general, but in the larger size either mechanical charging of cold materials or the use of hot metal charges is usual."

Again asserting that the usefulness of the electric furnace to engineering and industry has just begun to be appreciated, Mr. Mathews said that, besides being used extensively in the steel industry, "the electric furnace is also a recognized factor in melting nonferrous alloys, such as brass and monel metal, as well as especial alloys, such as nichrome, rezistal, stellite, stainless steel, manganese steel and high-speed steel, besides an endless variety of the simpler alloys and carbon steels from the mildest to the hardest tempers." Right now "the electric product is opportune to meet the new and exacting requirements for ordnance, automobiles and aëroplanes and other devices in which alternating stresses are very severe. The electric furnace also has some possibilities in this country for the manufacture of pig iron from the ore."

*Proceedings, American Institute of Mining and Metallurgical Engineers, Vol. LXVII, page 317.

Lighting in Relation to Safety

THIS is the subject of a pamphlet issued by the Edison Lamp Works of the General Electric Company and is one of a series of bulletins on the general subject of lighting. Because of the greatly increasing interest in the safety movement from both the welfare and the financial points of view a study of the relation of adequate illumination to safety is of interest. A discussion of the magnitude of the safety question is followed by examples of improper lighting—glaring lights, insufficient lighting, improperly placed lights, etc.—and of correct and adequate lighting to show how safety is retarded or promoted thereby. The pamphlet says:

In a well lighted shop, obstructions being more readily visible, are much more likely to be removed, or even if not removed, are likely to be seen by the workmen, and thus accidents are avoided.

Similarly, over a wide range of conditions, good illumination is the best possible warning of danger, facilitating the removal of the cause and further helping the employee to see any dangerous conditions and thus avoid danger. An employee is certainly entitled to this protection. Few employers would think of letting a blind man go in among powerful machines in a workshop, yet it often happens that they render an employee partially blind by glaring or inadequate illumination.

It is impossible so to guard a sharp-cutting tool that it is not possible for an operator to reach its danger point. If it is not clearly visible, injury is liable to occur, even though the best obtainable device is used.

A peculiarity of good lighting is that it differs from many other safeguards in that it assists rather than impedes the workman, thus contributing toward raising the quality and quantity of the product. In other words, it pays from every point of view.

The writer also points out the value of proper lighting for automobiles, public and private buildings and streets, asserting:

In all walks of life, and in all occupations or recreation, artificial illumination is a necessity, not alone from the standpoint of making movements possible through the ability to see, but also from the humanitarian standpoint of assisting in making all of these safe.

Unit Labor Costs on Electric Construction

Figures for Installation Involving More than 50 Miles of Conduit, 8,500 Lighting Fixtures and 1,000 Switches, Based on Standard Cost-Keeping Records — Excellent Mechanical Equipment an Important Factor in Lowering Costs

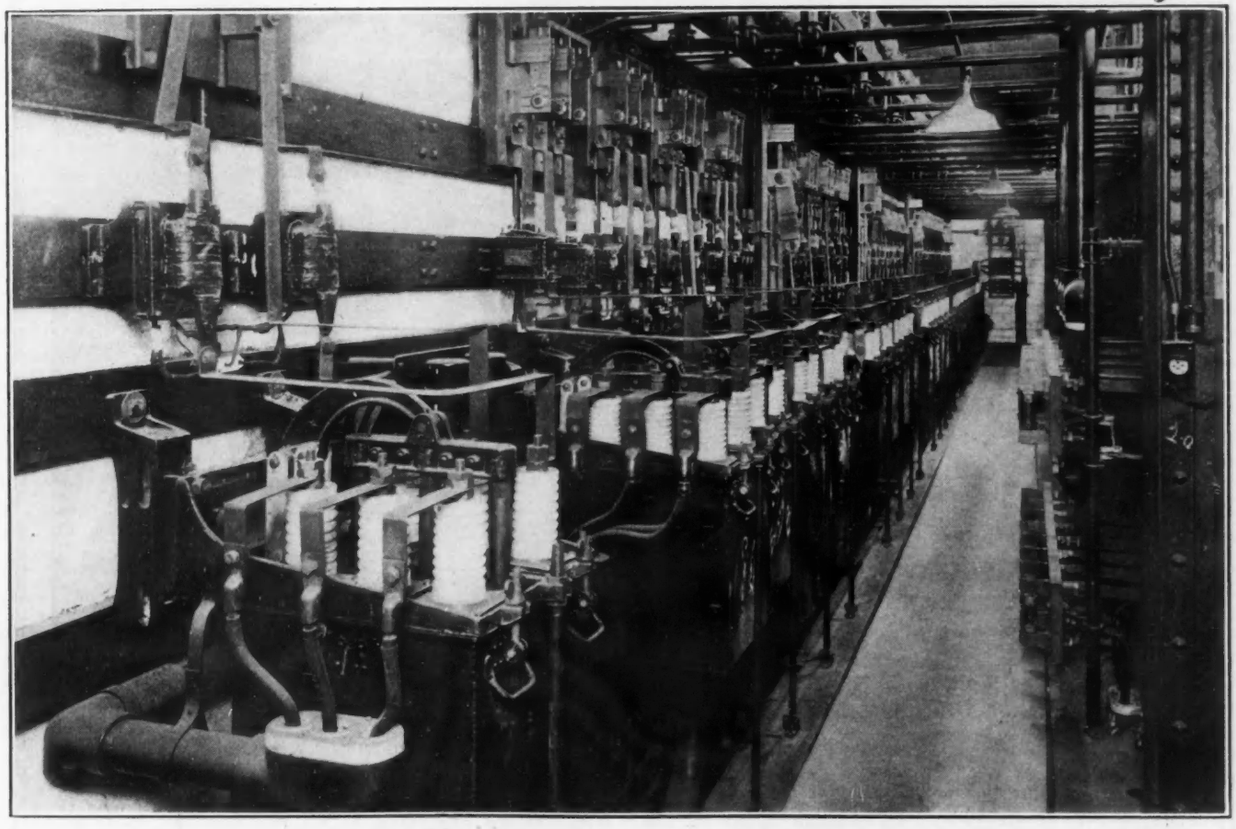
By CAMPBELL HIGGINS
With Hatzel & Buehler, Inc., Electrical Engineers and Contractors

ACCURATE records of the labor cost of installing electrical equipment kept during the construction of the Elizabeth (N. J.) plant of the Willys Corporation are presented here in detail on a unit basis. The work involved the installation of circuits, switches, outlets and fixtures for an industrial plant having more than 1,800,000 sq.ft. of floor area, and it consumed eighteen months' labor immediately subsequent to April, 1920. As brought out in Table I, more than 50 miles of conduit, 8,500 lighting fixtures and 1,000 switches were installed. The relative amounts of productive and non-productive labor required for roughing, wiring, installing apparatus and finishing are indicated in Table II. Table III, which gives the unit cost of construction, exclusive of material, is classified so as to permit ready reference.

When the work was undertaken speed was considered the essence of the contract, which was to be completed in five or six months, and observations showed that this result would probably be attained. However, a change of program went into effect a few months after the start, with the result that our work required eighteen months to complete. Although the concrete buildings were erected and the electrical work nearly completed in six months, using a gang of about sixty men, the steel structure or main shop was not erected until work in the concrete buildings was nearly completed. When it was erected the electrical work was slowed down at the owner's request on account of change in policy, so that for many months the actual construction was carried on with a force of ten men and one superintendent.

As a result of this change alone two noticeable effects were observed, (a) the productive labor was accomplished for considerably less than the amount estimated, while (b) the non-productive labor was found to be greatly in excess of the amount estimated. The total labor expended was close to and less than the amount estimated. Despite the fact that the wage scale for wiremen and helpers increased a dollar a day after the third month of the work, the construction was completed with a net expenditure for labor 3 per cent ($2,700) below that estimated.

The general conditions affecting labor during the life of the contract, and which will have to be considered in future work, are given below. The physical conditions



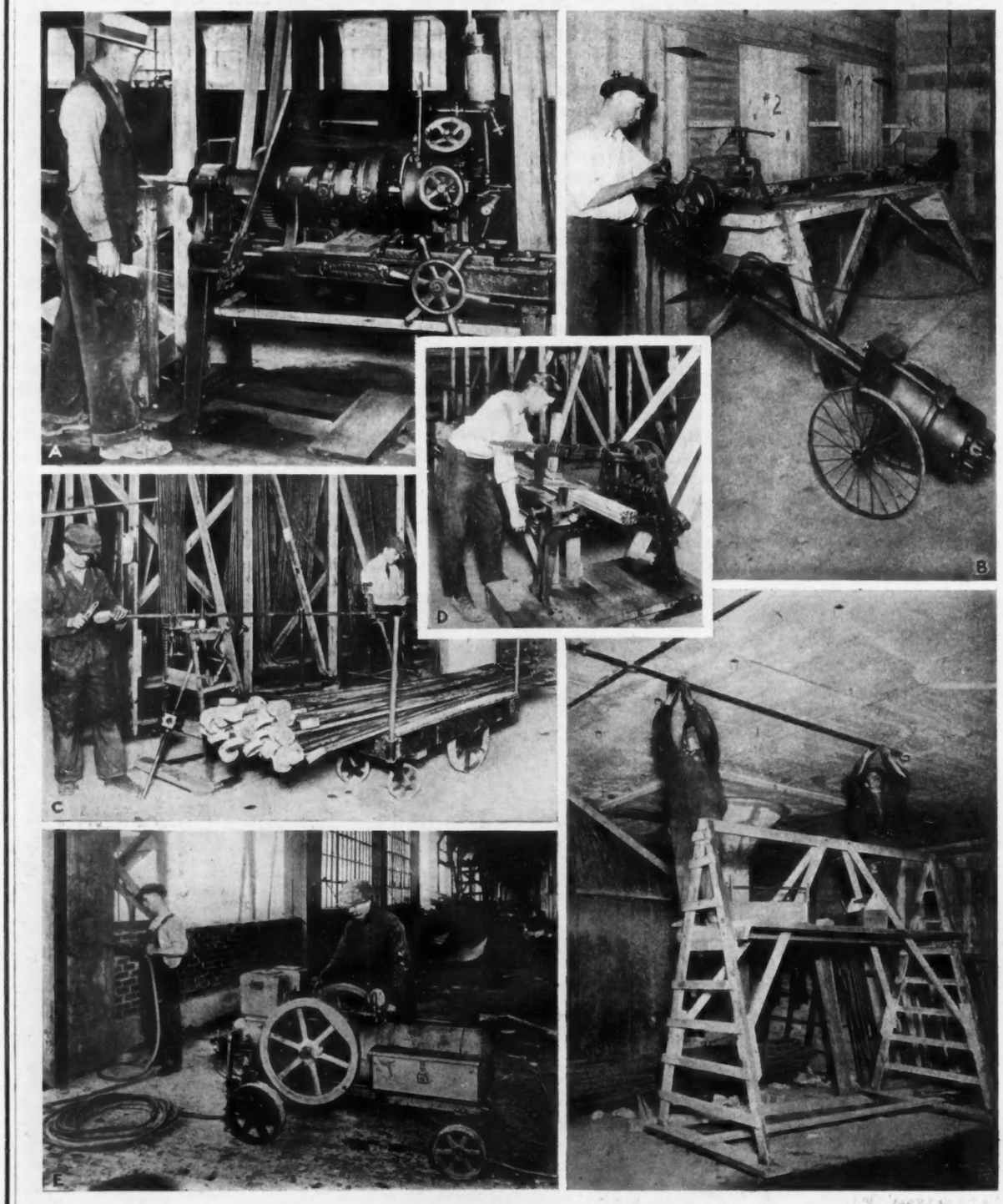
NATURE OF ELECTRICAL WORK BACK OF SWITCHBOARD

Note method of mounting oil switches, current transformers, disconnecting switches and overhead bus. The 4-in. x ¼-in. bus is under floor and runs to the main disconnecting switch.

affecting the work are briefly described under each item in the cost data.

Owing to war conditions a lowered efficiency was noticeable during the first three or four months and resulted in a slightly increased expense for the small conduit installation in the concrete buildings. Consequently those particular data are subject to discount on future work.

Because of the location of this unusually large job in a small city and the existence of a local union sufficiently well established to prevent the use of outside labor but not capable of furnishing a large number of



MECHANICAL EQUIPMENT USED IN ELECTRICAL CONSTRUCTION

A—Machine-driven pipe cutter and threader used mostly for ½-in. and ¾-in. conduits. B—Portable power-driven threader for large conduits. C—Attaching outlet boxes for conduits prior to installation; box complete on one end and lock nut on other. Note rack for storing conduits. D—Power-driven hacksaw used on job for cutting small conduits to length. E—Portable air compressor and drill used in mounting electrical equipment. F—Rolling scaffold used to install branch conduits in all concrete buildings. Note the threaded inserts in ceiling to which pipe hangers are secured.

TABLE I—SCOPE OF WORK TO WHICH COST DATA REFER

Floor area* of assembly, storage, manufacturing and shipping Buildings (sq.ft.)	1,820,300
Amount of equipment installed:	
Lighting outlets:	
R.L.M.	8,100
Cooper Hewitt	560
Switches:	
Toggle (30-amp.)	775
Push	340
Receptacles and plates	150
Extent of conduit (miles):	
Branch circuits	41
Main feeder	15
Period of work (months)	April, 1920, to December, 1921
Labor wage† (per day):	
Journeymen	$8 to $9
Helpers	$4 to $5

* The assembly buildings are of reinforced concrete without beams, whereas the shop bays are structural steel.
A power house measuring 140 ft. x 80 ft. and containing two 2,000-kva. turbo-generators, one 3,000-kva. unit and a 75-ft. switchboard was also constructed.
† Lower rates are for period up to August, 1920.

skilled men, a lowered output was experienced. This condition of affairs resulted in a serious restriction during the time the force on the work was being increased and it was noticeably less from the time of the first layoff on Aug. 1. The cost of installing small conduits in the concrete buildings was somewhat increased. The effect of these conditions on work in similar surroundings cannot be discounted unless the wage scale is correspondingly lower than has ordinarily been the case.

Another important cause of increased cost for the small conduit installed on the ceilings of the concrete buildings was the lack of any suitable and adequate mechanical means of drilling for the lead anchors used to support the ceiling outlets. (The pipe straps were secured by means of screws in wood inserts.) About half the outlets were secured to bolts set in the forms, but in the other half (in the area where the forms had been poured) the holes were drilled almost entirely by hand. This was necessary because the portable air compressor which it was intended to use for this purpose arrived at the job too late, and its use was found to be impracticable owing to the wide field of operations, its weight, the condition of the floors and the fact that no elevators were in operation at the time.

While it is safe to say that the costs were considerably increased on this account on this particular job, it is highly probable that the same cause would have been much more serious had it not been for the wooden inserts. However, since the inserts were clearly shown on the estimating plans and dependence had been placed on their use, the lack of speed in the remaining drilling was a net loss so far as the units were concerned.

The foregoing experience would seem to come under that class of contingency which makes its appearance on every job and causes contractors to be very slow to figure new work on the basis of the lowest figures ob-

TABLE II—GENERAL CLASSIFICATION OF LABOR EXPENSE TAKEN FROM COST RECORDS

	Percentage of Productive Labor	Percentage of Total Labor
Roughing—Conduits; outlets, boxes	64.2	47.8
Wiring—Pulling all wires and cables	13.4	10.0
Apparatus—Installing and connecting switchboard, panels, cut-outs, buses, etc.	12.7	9.4
Finishing—Installing and connecting switches, receptacles, fixtures, watchman's clock	9.0	6.7
Unassigned	0.7	0.5
Total productive labor	100.00	74.4
Total non-productive labor*	31.86	23.7
Temporary light and power and replacements	2.4	1.9
Total labor	134.26	100.0

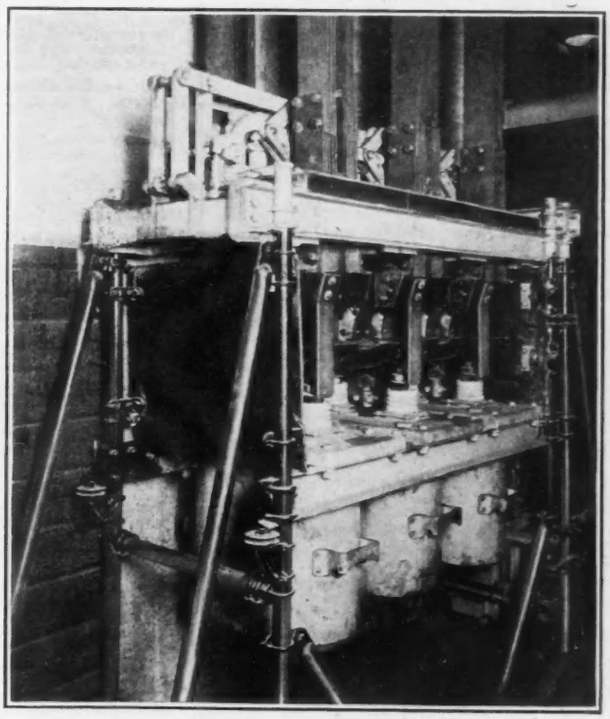
* Includes erecting office, stockroom, thirty rolling platforms, clerical work (two men, two boys), laying out work (subforeman), general supervision (superintendent and field engineer) and handling material.

SAMPLE OF FINISHED CONDUIT WORK AND PANEL-BOX INSTALLATION

Observe that the pipe-strap inserts on each side of outlet box are of wood, while the remainder are of metal threaded for ¾-in. bolts.

tained in the past on the same class of construction. Despite the above difficulties, the productive labor for the job was more than $10,000 (7 per cent) less than estimated. This was due to a number of well-defined causes, but principally to the fact that all during the last year of the work the conditions of the labor market were exactly the reverse of conditions experienced during the first few months.

Another very important factor in the lowering of labor costs was the splendid mechanical equipment provided for the work. Among the more important items were thirty rolling scaffolds for work on the ceilings, power-driven hack saws, power-driven pipe threaders of all sizes, air-compressor and drilling outfits which proved of the greatest value on the larger holes, a well-equipped blacksmith shop where much standardized work



CIRCUIT-BREAKER MOUNTING AND GENERATOR BUSES INSTALLED FOR 60 CENTS A FOOT

Table III—Itemized Construction Expenses Expressed in Terms of Unit Cost

The costs given below are as nearly correct as they can be made considering the prolonged life and size of the job. The sum of the items checks with the actual payroll.

CONDUIT

Installing—In the assembly, stock and test buildings, which were built of reinforced concrete without beams, the conduit hangers and outlets were run exposed and fastened to ⅜-in. threaded metal inserts spaced 3 ft. 4 in. throughout. Wooden blocks were provided at the center of each bay for attachment purposes. In general all ceilings are 11 ft. high. In the structural steel buildings the conduits are hung from the trusses.

½-in. and ¾-in.	Unit Cost
73,000 ft. ½-in. galvanized 35,550 ft. ¾-in. galvanized 67,850 ft. ½-in. loricated 14,500 ft. ¾-in. loricated	
190,900 ft. all systems (per foot)	$0.1262
Concrete buildings, including changes 73,000 ft. ½-in. galvanized 35,550 ft. ¾-in. galvanized (per foot)	0.1428
Concrete buildings straight new work with changes deducted. 72,000 ft. ½-in. galvanized 35,000 ft. ¾-in. galvanized	
107,000 ft. (per foot) 7,070 lighting outlets; average run 15 ft.; approximate 10 ft. counting junctions; 70 per cent at lower wage scale.	0.1275
First 25,500 ft. standard layout on ceiling cost (per foot)	0.119
Shop transfer bay, receiving bay, etc., about one-quarter concealed, rest exposed. 67,850 ft. ½-in. loricated condulets 14,500 ft. ¾-in. loricated condulets	
82,350 ft., 75 per cent high up on steel (per foot)	0.1044
1-in. and 1¼-in.	
Concrete buildings, including a number of changes. 25,400 ft. 1 in. 1,600 ft. 1¼-in.	
27,000 ft. (per foot) The above figure includes costs which do not properly belong in the cost of running the conduit, and therefore the unit is too high. The following figures which were determined on the job before changes were made are accurate.	0.155
Home runs: 23,450 ft. 1-in. 660 ft. 1¼-in.	
24,110 ft. (per foot)	0.1302
In shop on hangers suspended from concrete floor of balcony. 5,000 ft. 1-in. 3,000 ft. 1¼-in.	
8,000 ft. (per foot)	0.106
Long straight runs with boxes approximately 20 ft. apart.	
1¼-in. and 2-in.	
Concrete buildings: 10,350 ft. 1¼-in. (long power lines) 2,360 ft. 2-in. (lighting feeders)	
12,710 ft. (per foot)	0.19
From job records: 7,950 ft. 1¼-in. long horizontal runs in single lines hung from ¾-in. inserts (per foot)	0.12
Shop, etc.: Mostly two conduits on same hangers hung from concrete floor of balcony. 3,000 ft. 1¼-in. boxes, 20 ft. on centers. 8,960 ft. 2-in.	
11,960 ft. (per foot)	0.104
2,360 ft. 2-in.; each run 100 ft. horisontal and up to fourth floor through sleeves and feeding three or four lighting panels (per foot)	0.40
2½-in. and 3-in.	
All buildings: 5,950 ft. 2½-in. 11,750 3-in. Runs up to 1,300 ft. all horizontal. Mostly on channel irons in truss and tunnel; also power house.	
17,700 ft. total (per foot)	0.322
3-in. conduit on channel iron hangers in tunnel; three runs 1,300 ft. plus each; conduit within reach from floor, pull boxes 400 ft. apart, two offsets; all horizontal, hangers not included.	
3,945 ft. 3-in. conduit (per foot)	0.22
3-in. conduit from main switchboard through power house and tunnel to stock bldg., with reduced but efficient gang. Conduit runs with many angles and sets, so that work was of most difficult nature.	
770 ft. 3 in. conduit (per foot)	0.29

3½-in.	Unit Cost
In one straight horizontal run on pipe hangers in threaded inserts. 1,100 ft. 3½-in. conduit (per foot)	$0.16
Cutting and Threading Forty nipples from 3-in. conduit, each 15-in. long using power hack saw and hand Toledo (per nipple)	2.29
Hangers	
Drilling concrete ceilings for:	
All holes within space of eight bays using air compressor and one team; seventy-two ¾-in. holes each approximately 1½ in. diameter (per hole)	0.36
Making	
Forge work, making all kinds of hangers, etc. at forge and drill. Making 100 hangers of 4-in. channel iron, 4 holes (each)	0.35
Installing	
The cost of this work was generally included in the cost of the conduit except as noted below: In tunnels 4-in. channel, each 3 ft. long using threaded inserts, 100 hangers (each)	0.81

BOXES

Setting

Lighting-panel boxes in all concrete buildings:	
All boxes exposed on pilasters, with four expansions, holes drilled with air hammer. Compressor in same position for four or five boxes.	
106 boxes at	2.83
1,456 circuits, at	0.21
Power-panel boxes in all-concrete buildings:	
Boxes about 2 ft. square, 4 in. deep set on T. C. partition, 100 amp., three-pole, thirty-one two-circuit, six three-circuit (per box)	3.73
Secondary-lighting boxes:	
Each box 44 in. x 44 in. x 24 in. Six built in T. C. wall (per box) One free standing on pipe supports (per box)	12.00 27.00
Pull boxes:	
1 box 28 ft. x 18 in. x 18 in. (four-side) 1 box 15 ft. x 20 in. x 10 in. (four-side) 1 box 20 ft. x 18 in. x 16 in. (two-side) 1 box 32 ft. x 34 in. x 20 in. (four-side)	
4 boxes installed (per box)	40.25
Seven boxes each 14 in. x 11 in. x 3½ in.; also setting and connecting seven automatic starters for blower motors on roof, under bad conditions. (per outfit)	20.00
Section-switch and power-junction boxes:	
On ceiling of concrete buildings at long intervals.	
Each box mounted with a single ¾-in. tap bolt to threaded insert, principal cost involved being the location of the box and handling ladders. 74 switch-boxes 18 in. x 12 in. x 6 in. 143 junction boxes 24 in. x 8 in. x 6 in.	
217 total (per box)	1.20

PANELS

Setting and connecting

Lighting panelboards and trims (tumbler-switch type)	
106 panelboards (per panel)	7.14
1,456 circuits (total) (per circuit)	0.52
Secondary panels for lighting. Each consisting of single slate slab with three 200-amp. or 400-amp. three-phase double-throw-back connected switches.	
Seven panels and trims (per panel)	17.14
126 connections No. 4/0 and 500,000 circ. mil (per connection)	1.00
Power panels and trims (wall cabinets), 3 to 3 wire fuse panels, no switches.	
Thirty-seven panels, two circuits (per panel)	7.41
370 lug connections, Nos. 4, 2, 1 and 4/0 (per connection)	0.74
Primary power-panels, one three-pole, 400-amp., nine lugs each.	
Eight panels (per panel)	16.50
Seventy-two lug connections, No. 4/0 and 400,000 circ. mil (per connection)	1.83
Heavy slate panels (two) in boxes on ceiling, each panel having one 600-amp. and one 400-amp., two pole switch with fuses (setting only) (per panel)	8.75
Polarity power panels and compensators, in shop (total)	190.00

SWITCHES AND CUTOUTS

Setting and Connecting Unit Cost

Main line cutouts in all buildings. Mostly 400-amp., three-pole, with three 500,000-circ.mil main and six No. 4/0 branches (total)	$210.00
Safety switches, eleven 100-amp., three-pole 8 ft. up on T. C. wall (cranes) (per switch)	3.82
Section switches, three-pole, single-throw, unfused, 100 amp., 440-volts, in boxes widely distributed on ceiling	1.40
Safety switches, D. C. (total)	248.00
Cut-outs Plug and N. E. C., 245 in main shop, for light and power, in very small boxes on ceiling, under very bad conditions. Cut-outs mostly 30-amp., plug type, three-pole, none larger than 100-amp. (per cutout)	3.62
Wall switches and plug receptacles, including plates. 334 double-pole switches in cast-iron boxes, 150 standard receptacles and plates.	
484 Total (per unit)	0.48
Shop toggle switches (846 30-amp. G. E. tumbler type); generally mounted two to a box and each switch secured with two screws in tapped holes. (per switch)	0.343

FIXTURES

Hanging and connecting

5,000 Benj. RLM, 100 to 200-watt, with S neck and box fitting. 703 Benj. RLM. 200-watt, on stems with Benco socket. 226 Duplexalites, 100 to 200-watt. 237 Miscellaneous lamp receptacles, and angle reflectors, assembling.	
6,166 (total) (per unit)	0.457
Fixtures of various types and methods of mounting, generally suspended at 25 ft. height from conduit attached to stem. In many cases the cost includes pulling 20 ft. to 40 ft. of duplex (used traveling crane) 282—500-watt Benj. RLM. 119—500-watt Benj. Elept. 579—500-watt Ivanhoe RLM. 36—100-watt Benj. RLM.	
1,016—total including making up 385 small strap iron hangers (per unit)	1.00
Stem hangers (326) for Cooper Hewitts in assembling buildings, using stems of ½-in. pipe, couplings, 1 in. x ¼ in. strap iron and two-hole pipe strap and two ¼-in. round iron hangers (per hanger)	1.30
Cooper Hewitts (326) to the above stems. Mounting height about 11 ft. (per unit)	0.92
Total cost per lamp	2.22
(268) in shop, lamps hung close to steel at mounting height of about 13 ft. Including making small strap hangers, and connections with 2-ft. lengths of "canvasite." (per unit)	1.30

WIRE AND CABLE

Pulling—In all cases on pulling the costs recorded cover the cost of setting up reels and all preparations. No splicing nor connecting is included.

Practically all 400,000; 500,000; 600,000; 700,000; and part of the No. 4/0 cable was pulled with the aid of a powerful electrical truck and largely without the use of tackle except a snatch block used as a fair leader.

Nos. 14 and 12 duplex; all buildings	
292,000 ft. No. 14 duplex 28,000 ft. No. 12 duplex	
320,000 ft. (total) (per 1,000)	13.10
In the concrete buildings more than 230,000 ft. of duplex evenly divided between ½ in., ¾ in. and 1 in., where the 1 in. runs were very long, cost (per 1,000)	13.50
In the shop and high bays more than 65,000 ft. of duplex, about half of which was pulled by climbing on the steel, cost (per 1,000)	12.00
In concrete buildings, the cost of pulling duplex above includes the cost of a large part of the splicing and all tagging of ends.	
Nos. 10, 8, 6 single rubber-covered, all buildings, all kinds of runs. 11,000 ft. No. 10 single 6,000 ft. No. 8 single 7,000 ft. No. 6 single	
24,000 ft. total (per 1,000)	7.90
Nos. 5, 4, 3, 2, 1 single rubber-covered. 31,000 ft. No. 4 single, long power runs. 13,400 ft. No. 2 single, long power runs. 7,600 ft. No. 1 single, long power runs.	
52,000 ft. total (per 1,000 ft.)	12.23

(Table III continued on page 1097)

Table III—Continued from page 1096

	Unit Cost
Three-wire runs in 1½ in. conduit on ceiling, long single lines.	
No. 1/0, 2/0, 3/0, 4/0, rubber-covered:	
2,000 ft. No. 1/0 long power runs	
15,300 ft. No. 2/0 part used as neutral	
26,700 ft. No. 4/0 long power runs and light.	
44,000 ft. (total) (per 1,000)	$22.34
Mostly in horizontal runs, typical of a large plant. A considerable part of the No. 2/0 was used as the neutral leg of two 500,000 circ.mil wires, and as that part was prorated the cost may be a little high.	
400,000 circ.mil varnished cambric	
28,040 ft. 400,000 circ.mil varnished cambric (per 1,000)	37.25
Mostly in horizontal runs with a maximum length of 1,300 ft. plus one way. Evenly divided between runs on low tunnel ceiling and runs in truss about 25 ft. up, no splices included.	
Average price in tunnel, no splices	22.00
500,000 and 600,000 circ.mil. rubber-covered.	
15,000 ft. 500,000-circ.mil.	
600 ft. 600,000-circ.mil.	
15,600 ft. (total) (per 1,000)	34.90
Two or three long runs and the rest comparatively short; horizontal.	
700,000 and 1,000,000 circ.mil rubber-covered.	
1,760 ft. 700,000 circ.mil. pulled in one two-wire run with one bend and two offsets, horizontal line with two pull boxes.	
1,760 ft. (total) (per 1,000)	23.00
180 ft. 1,000,000 circ.mil in two two-wire runs (per 1,000)	128.00
Splicing	
700,000 circ.mil in boxes installed on ceiling:	
Four splices made with sleeves / Six connections to lugs / 400,000 and 500,000-circ.mil.	Each 2.80
Accurate costs kept on a number of splices at three locations show the following results for splices made with sleeves:	
a. Difficult overhead conditions, each	3.00
b. Fair to good conditions, each	2.00
1,000,000 circ.mil. sweating four lugs	3.50
CAPPING OUTLETS USED AS JUNCTIONS, LOCATING TROUBLE, TESTING, ETC. (TOTAL)	**200.00**

MAIN GENERATORS

	Unit Cost
Bus work, installing under engine-room floor between three machines and switchboard, including making-up from bar copper and installing complete with pipe supports and insulators; also including connections to three oil switches and up to "disconnects" at board.	
Two 2,000-kva., three bars per leg	
One 3,000-kva., four bars per leg mounted direct to beams with pipe supports alternating. Ninety-six bus supports.	
2,300 ft., 4 in. x ¼ in. bus (per ft.)	0.602
Oil switches, installing, located on side of concrete generator foundation with pipe supports to floor.	
Three oil switches (per switch)	32.83
Field wires, connecting (per machine)	8.00
Direct-current exciters, connecting	
One 25 kw.	
One 75 kw. (per machine)	$20.50

MAIN SWITCHBOARD

	Unit Cost
Erecting and connecting thirty-seven panels main switchboard, complete (per panel)	55.00
Does not include generator bus, pull box or conduit work on feeders.	
Drilling holes in 4-in. channel mounted on wall using electric drill, for oil switches, current transformers and disconnecting switches.	
400 holes (per hole)	0.272
Mounting twenty-five 400-amp. oil switches (per switch)	8.24
Making and placing operating gear of ¾-in. pipe for above, at various angles (per switch)	8.00
Setting twenty-five disconnecting switches (per switch)	4.68
Current transformers (six) *(per transformer)*	6.81
Erecting thirty-seven panel switchboard including pipe supports (switchboard proper):	
Mounting panels and frames $300	
Mounting panels and small bus 212	
Miscellaneous work behind board 280	
Small wiring at rear 188	
Generator panels 28	
Thirty-seven panels erected $1,008	27.47
Erecting G.E. bus and supports, all cut to fit assembled and erected on pipe supports, 260 ft. single, bus, 97 supports (per ft.)	0.634
Connecting twenty-five oil switches (per switch)	5.62
150 lugs, all 400,000 and 500,000 circ.mil. (per lug)	0.937
Changing twenty-five meters (per meter)	1.12
Testing and filling twenty-five oil switches (per switch)	0.88

TRANSFORMER BANKS

	Unit Cost
Connecting	
440-volt, three-phase, to 110-220-volt, each transformer having five connections, including filling with oil.	
Transformers were placed on rails by others and all but two banks were placed at floor level. Two banks were mounted on exterior wall at second floor level.	
15—50-kw. transformers	
12—100-kw. transformers	
3—200-kw. transformers	
30 (total) transformers (per transformer)	12.57
150 (total) connections (per connection)	2.51

DYNAMOMETER CONTROL BOARD

	Unit Cost
Installing and Connecting	
Forty-four panels for testing finished automobile engines; each board consisting of slate panel about 2 ft. square, mounted on 1½-in. pipe frame, free standing from floor.	
a. Setting two vertical pipe supports and two braces by means of four floor flanges having two holes each; eight holes per frame; 352 holes total. Drilling done with heavy air hammer.	
b. Securing braces and mounting panel with standard U-bolts.	
c. Twenty-five small connections to resistance. Two line connections (no motor connections). No. 4 wire.	
d. Mounting resistance grid at rear, with four U-bolts. (Per panel)	$9.66
The above panels were set in lots of twelve at one time, and the costs given would be exceeded without the aid of a good air hammer.	
Instead of expansion bolts, we used standard bolts leaded into holes.	

WATCHMAN'S SYSTEM

	Unit Cost
Installing	
Iron-back boxes (87) for watchman's magneto stations. Boxes 6 in. x 6 in. x 1 in., each fastened to concrete with two ¼-in. expansions. (Boxes so widely distributed that to ring in rotation an 8-mile walk is necessary) (per box)	0.85
Cast-iron W. P. boxes (per box)	5.10
Annunciator of 100 drops, also 100 point interconnection strips in box (includes connecting)	180.00
Time clock and racks (non-electrical)	34.00
Nos. 16 and 14 single wire, all buil ings.	
72,000 ft. No. 16 single	
8,000 ft. No. 14 single	
10,000 ft. No. 16 duplex	
90,000 ft. (total) (per 1,000)	3.55
The above cost includes the connections to eighty-seven magneto stations. This wire was pulled into all sizes of conduit from ½-in. to 1¼ in.	
Unassigned costs (total)	464.00

CONVERTER AND BATTERY OUTFITS

	Unit Cost
Installing	
Rotary converter board of four panels of 1¼-in. slate on free standing frame, including some corrections of bus work; includes most connections (total)	164.50
Seven battery-charging boards, including making and setting angle-iron frames secured to floor and wall with four bolts per frame. Similar to small motor starters (per board)	11.00
House battery, 110-volt set with charging panel and connections to motor-generator set, including the initial charge (total)	133.00
Truck-charging board, secured to wall; no connections (total)	44.76

CRANE SYSTEM

	Unit Cost
Installing	
Coal Crane wiring, complete	235.00
The above figure covers the cost of practically rebuilding the crane from an electrical standpoint. Milwaukee crane man states that his firm considers the cost of assembling and connecting the electrical work on a properly shipped crane should be.	75.00
Trolley wire, approximately 900 ft., No. 1/0 bare, bad conditions (per 1,000)	96.00
Trolley insulators and blocks on I-beams already drilled.	
700 pine blocks, 13 in. x 5 in. x 3 in., purchased with drilling for bolts and screws. (each)	0.40
Two 6-in. x ¾-in. bolts and nuts (each)	0.04
Three 7-in. x ¾-in. lag screws (each)	0.04
Three 4-in. porcelain spools (each)	0.35
700 blocks assembled and installed (per block)	0.27
Material cost of each complete outfit	1.65

BLOWER MOTORS

	Unit Cost
Connecting	
Seven alternating-current, installed in power house using No. 4 wire (each)	11.60

was done, excellent storage and handling facilities, including hand trucks, and, lastly, in the case of the heavy pulling on extremely long cables, the use of powerful electric trucks.

One point to be considered in using the accompanying unit costs on future work is the proper allowance for non-productive labor. The allowance shown was entirely correct for this particular job. Owing to the fact that those performing work of this class were at no time engaged in work with tools, it was possible to be very accurate in the cost keeping. As Table II indicates, the non-productive labor was 31.86 per cent of the productive labor. From studies made in the field it seems safe to say that had the work been carried out as planned in the five months' time, the percentage estimated (15.8 per cent of the productive labor) would have been approximately correct, because the field office force would not have been increased and was in fact organized with this particular task in view. The field force was retained during the entire five months which should have seen the job nearing completion.

In considering new work it would seem proper to take 15 per cent as a minimum for the ratio of non-productive labor to productive labor where the conditions are sure to be good with respect to speed of operations—and proportion of space sure to be available at one time. The upper limit for non-productive labor should not be over 32 per cent for a large operation. Furthermore, where there is any likelihood of the work being dragged out at the end of the job, or of serious delays being experienced during the life of the job, the percentage allowed should be nearer 30 per cent than 15 per cent.

Increasing the Reliability of Service

Opportunities Offered Through Regular Inspection, Constant Interpretation of Plant Records, Ring Feeders and Ample Reserve

BY FRED D. GORDON

General Manager Cumberland County Power & Light Company, Portland, Me.

NO MATTER how fast the expansion of central-station service takes place, no matter how rapidly gains in operating efficiency may be realized, reliability remains in the very front rank of importance. It is of little avail to install larger and larger units if the continuity of service is not adequately safeguarded. Higher economies in plant performance are also of little significance if these are accompanied by frequent or protracted interruptions. The bad effect of poor and unreliable service upon public relations ought to be self-evident and is apparent apart from its damaging influence upon operating revenues.

The active interest of utility executives in the quality of service rendered by their companies ought to be spontaneously accorded. The story the log sheet tells is quite as important as the morning mail. A searching study of the causes of every interruption is worth real money to a progressive operating company. Systematic handling of plants and lines under a centralized control is demanded today in place of the older and more haphazard methods.

TOO LITTLE ATTENTION PAID SERVICE RECORDS

As a public utility executive I believe that too often only a perfunctory interest in the service record from hour to hour is displayed by central-station managers and superintendent. It is not at all difficult to change all this, if the manager cares to do it. On our property a complete log sheet covering the major events of importance for the twenty-four hours ending at 7 a.m. is placed upon the executive desk every morning before 8 o'clock. We can see at a glance how every unit in each of our hydro-electric and steam generating stations was handled during the preceding twenty-four hours, note the variations in the height of water in the forebays, follow the load curve of the system from half-hour to half-hour, see what transmission lines were in service from hour to hour, study station outputs, fuel consumption and numerous other points. Log sheets of excellent design are common enough in the central-station industry, but unless such records receive close scrutiny from executives while they are fresh, opportunities may be lost to initiate investigation of great value. Incidentally, the esprit de corps of an organization is maintained at a higher level when the staff knows that the management has a real interest in its work and stands ready to give co-operating direction in the handling of the system to obtain the best possible efficiency.

Right after an interruption is over is the time to "get down to brass tacks" and study its causes and future prevention. The failure to do this is a weakness by no means rare among operating companies. Superficial notes to the effect that "Line No. 4 'shorted' at 8:20 a.m.; 'juice' on at 8:28," are not of much value to any one. Operating failures should be reported as completely as possible, including the exact location of the trouble if it can be found, with results of inspections, observations at the time of interruption, tests of insulators removed, etc. It is better to have such reports a little too full of detail than "shy" of data, because the value of plant and line records lies chiefly in the possibility of interpreting them as guides for future work.

The ideal report of an interruption is one that will satisfy the engineering mind by its completeness of details. The failure of the operating organization to put down on paper all possible *essential* data hampers the management in its efforts to arrange for better service in the future. In making clear to system operators, station men, line foremen and other employees what sort of information is really important when studying service interruptions, a field of activity exists which at present is far from thoroughly covered.

Engineering studies of transmission-line development, of the cost and value of ring feeders, of the relation between reserve plant capacity and load requirements and of equipment obsolescence contribute so much to securing greater service reliability that they should not be neglected. On the Cumberland County system a program has lately been carried forward with the idea of establishing a complete double-loop transmission system connecting the major plants and more important substations, and with the building of a new steam plant in South Portland for auxiliary service a double-ring system will ultimately be provided in the city itself. There is no question, in my opinion, that stand-by steam generating capacity is essential even where excellent storage facilities are available for the hydro-electric plants. At such plants fuel oil means the possibility of securing economical operation even when running at load factors of 10 or 15 per cent, and of course the speed of getting into action in such plants is of immense value from the standpoint of service reliability. The choice of units in such plants is closely related to service reliability, and where two machines of equal size go in rather than one unit of double the rating the possibilities of all-day economy as well as the reliability factor are naturally better.

OLD EQUIPMENT SHOULD BE DISCARDED

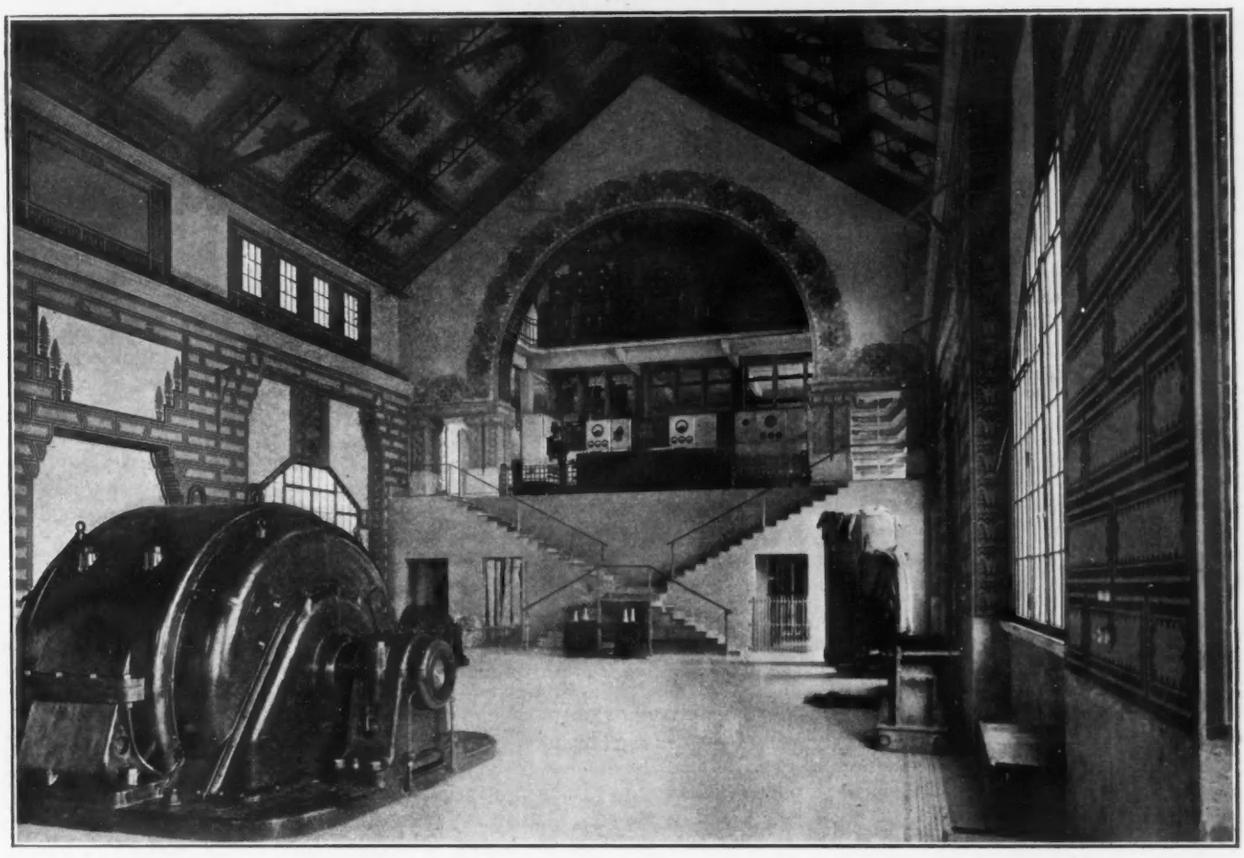
On many systems there is a strong temptation to retain old-time and obsolete apparatus for possible emergency service requirements. On the score of overhead cost this practice is very undesirable. It admittedly swells the assets of a company to retain a lot of hoary-headed old units of small size scattered about the property, but the labor cost of keeping these ready for service is by no means negligible. Rates should be sufficient to permit writing off obsolete equipment as junk and providing in its place modern apparatus of decent efficiency and adequate capacity. I cannot see where the cause of reliability gains by hoarding these old units.

As interconnection between adjacent systems proceeds the amount of reserve equipment necessary to handle a particular load cycle falls off relatively to the installed capacity, but it is unwise to attempt to get along with little or no stand-by plant. The hazards of transmission are real and cannot be reduced to zero with present available equipment. However, by systematizing inspection and maintenance methods and by arranging for rapid transfers of load to other lines or plant in case of trouble, service reliability can be greatly increased. Altogether, constant vigilance and continuous looking forward are essential to the making and holding of A-1 service records.

Intimate Notes from Italy

A News Letter That Visualizes the Italian Hydro-Electric Developments, the Scenery and the Courteous Hospitality of the Italian Engineers—The Electrified St. Gotthard Tunnel—Diesel Engines Rated at 3,000 Hp.

By MORGAN BROOKS
Professor of Electrical Engineering University of Illinois



AN EXAMPLE OF THE SPLENDID ARCHITECTURE AND DECORATIONS OF ITALIAN POWER STATIONS IS THIS INTERIOR OF THE CREGO POWER HOUSE OF THE CONTI UNDERTAKINGS COMPANY

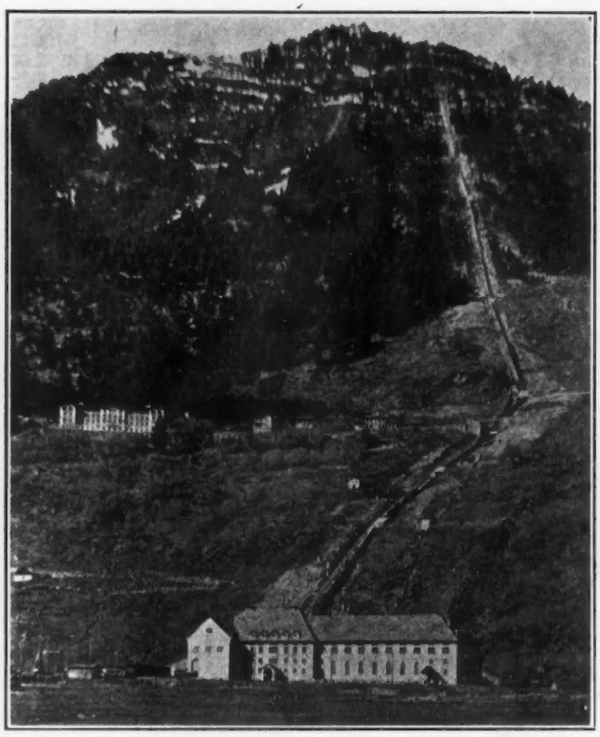
THE Associazione Elettrotecnica Italiana has just celebrated at Milan its twenty-fifth anniversary by holding a notable week-long convention with important papers and social functions. Through the courtesy of President del Buono and Past-president Guido Semenza—many of your readers met the latter at the Salt Lake convention of the American Institute of Electrical Engineers last year—it was my privilege to join the exceptionally interesting inspection trips which concluded the convention program. As the only American present I am sending you an account of these trips.

The party of more than five hundred engineers left Milan on the morning of Oct. 7 at 6 o'clock in a special train of new corridor coaches over the partly electrified Italian State Railway. At Domodossola transfer was made to twenty-seven automobiles, mostly of the "rubberneck" type. There were seats for all, since the arrangements, as might be expected from engineers, were perfect throughout.

Then began a most interesting climb of 1,000 m. (3,280 ft.) up the splendid Alpine roads with their zigzag engineering construction, more difficult than the Simplon Pass, giving superb views of rapidly changing scenery; for every turn, and the road was never straight, brought new points of attraction. Cascades were frequent, one suggesting the Staubbach by its extraordinary single leap. The day was cloudy, and occasionally a cascade would appear to drop down the mountain side out of the low clouds, leaving to the imagination the estimation of its full height. One of the scenic features was a ruined castle built upon an immense boulder carried into the valley ages ago by some prehistoric glacier.

In two hours, after passing three plants of the Società Imprese Elettriche Conti, we soon reached our destination, the plant at Valdo under construction, the highest of the chain of plants. The Valdo plant is far up the river Toce, near the Swiss frontier. High up the mountain slope toward the west the eye follows the

double penstock line until lost in the clouds 775 m. (2,443 ft.) above the Valdo station. A small lake, Vannino, augmented by a dam, together with two other lakes at even higher level, gives a storage capacity of 15,000,000 metric tons of water, insuring continuous power from the two turbines of 15,000 hp., each of Pelton type and Riva (Milan) make. The generators are three-phase, operating at 15,000 volts and 42 cycles and built by the Tecnomasio Italiano Brown-Boveri at Milan. The voltage is stepped up to 60,000 volts for transmission. Although the generators were of the modern inclosed construction, we were able to see them well as the winding of the armatures was in progress. The wonder is that the installation of such a plant should have been undertaken at all, requiring, as it did, the building of many miles of new road to make auto-trucks available.



A HIGH HEAD PLANT OF THE SWISS FEDERAL RAILWAYS AT RITOM DEVELOPING 48,000 HP.

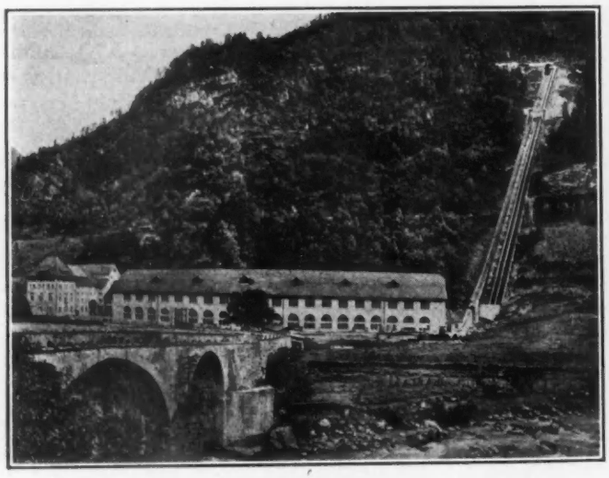
The call to "eats" was now made, and what was my surprise to find that the Società Conti had prepared a sumptuous lunch in the loft of its station, soon to contain the outgoing transmission wires. This made a big dining hall, but who would have expected special frescoes—no less a word applies—with winter sports scenes by an Italian artist of no mean ability and with words of welcome neatly lettered? It was the marvel of all that the company could serve a metropolitan lunch of five courses at so inaccessible a point. I learned that it had even installed a temporary bakery so that the rolls should be fresh.

As there were two sittings for the lunch, the second group, taking the trip in inverse order, were arriving just as the first were rising from the tables, so a combined group photograph of the party was taken in front of the power house.

The return trip was at a slightly faster pace, but the steepness and sharp turns of the road prevented speeding. Rain came on, and we were glad to reach one of the lower power plants in operation at Verampio. As indicated in the picture herewith, this plant is a wonder of landscape gardening and architecture. Indeed, it is evident that in Italy power plants are treated as important public enterprises worthy of artistic architectural treatment. Within the main building were found four smaller hydro-electric units, similar to those at the Valdo plant, but totaling only 20,000 kva. owing to the smaller available head—570 m. (1,870 ft.)—and the slightly less flow. The water storage is also less than at the higher plant. The four transformers at the Verampio plant are installed each in a separate house. The plant was put in operation in 1915, and as the units were completely inclosed interest centered in the switching and protective apparatus.

Walking a short distance, the party visited the Crego plant, which utilizes the entire flow of the Toce, here a much larger stream than is available at Valdo. This plant, in operation three years, furnishes another 20,000 kva., although the head here is but 198 m. (650 ft.). The Crego plant is across the valley from its neighboring plant.

In the entire chain of Conti plants are a number more in operation, and the future development in this d'Ossola Valley will more than double present output. The total probable output of the completed system is estimated at 600,000,000 kw.-hr. per year.



THE AMSTEG PLANT OF THE SWISS FEDERAL RAILWAYS DEVELOPS 55,000 HP.

THE VERAMPIO POWER HOUSE OF THE CONTI ELECTRIC UNDERTAKINGS COMPANY

By 5 o'clock the two sections of the party had returned to Domodossola and boarded their special train for Stressa, on Lake Maggiore, where at 8 p.m. three of the distributing companies using the Conti company's output joined in giving a complimentary banquet at the two largest lakeside hotels.

Early next morning the party boarded a special steamer on Lake Maggiore connecting with a Swiss special train for an inspection of the St. Gotthard electrification. This, the most extensive electrification undertaken in Europe since 1914, was begun in 1916; the first train was operated through the St. Gotthard tunnel in September, 1920, and since June of this year the entire line from the Swiss boundary at Chiasso, near Como, to Lucerne, a distance of 225 km. (140 miles), has been in operation by electricity. The quantity of coal used in 1915 was 100,000 metric tons. None is used today. Within a year the extension to Zurich will be in operation, and by the close of 1924 the line will be electrified to Basle on the French frontier. The St. Gotthard tunnel is only one-third the total length of 45 km. (28 miles) of tunnels on the line, and several other tunnels, each a nearly complete mile-long turn of a huge helix, are much more interesting examples of engineering skill in overcoming the quick ascents without too steep a grade. The tunnels and most of the line are double track. The sharpest curve has a radius of 280 m. (920 ft.) and the steepest grade is 2.7 per cent. When electric locomotives replaced steam not only were heavier trains operated but 15 per cent better speed was obtained, greatly increasing the passenger and freight capacity of this international route through the Alps.

GUESTS OF SWISS FEDERAL RAILWAYS

These facts were put before the members of the party in pamphlets distributed by the Swiss Federal Railways system, our hosts for the day. A ride of nearly three hours through Alpine scenery like that enjoyed the day before from the touring automobiles brought the train to Amsteg, not far from Lake Lucerne, where the Amsteg hydro-electric station, now almost ready for operation, was inspected. This plant, near the railway line, contains four 10,000-kw. units with turbines from the Ateliers de Constructions Mécaniques of Vevey, operating under 258-m. (840-ft.) head at 333 r.p.m. Three of these drive Oerlikon single-phase alternators for railway service at 16.6 cycles; the fourth drives a three-phase Brown-Boveri generator of 8,600 volts at 50 cycles for commercial service.

At noon a lunch provided by the Swiss Federal Railways was served at Amsteg, after which the party entrained for Piotta, near the south or Italian end of the Gotthard tunnel, where the Ritom power house was visited. Like that at Amsteg, this plant has four turbines of Pelton type, but the head is 800 m. (2,625 ft.), or three times that at Amsteg. All the generators are single-phase Brown-Boveri, 15,000 volts, 16.6 cycles, for railway service, and have been in operation since 1916. This plant has the advantage of a large storage lake of 26,000,000 metric tons of water, one hundred times the insignificant storage available at the Amsteg station. It is therefore expected that during the summer, when the water supply at Amsteg is ample, that plant will take all the load, allowing the lake to accumulate water for the use of the Ritom plant in winter.

The single-phase current at 15,000 volts as generated is fed directly into the trolley wires for sections adjacent to the power houses, but is stepped up to 60,000 volts for distant sections. The transformer substations are five in number and are housed in buildings, but it is proposed to add three more of the "open-air American type" in the near future. Transmission circuits are one-third underground and two-thirds overhead construction. No. 4/0 trolley wire is used, and the trolley wires are in duplicate within the tunnels. All are in catenary suspension at 18 ft. to 20 ft. above the rails in the open and 15.8 ft. above in the tunnels.

At Piotta the railway had placed on exhibition two of its heavy electric locomotives, weighing more than 100 tons each and averaging 2,000 hp. from its series-wound alternating-current motors. One, of Brown-Boveri design for passenger service, had the single-reduction gear connected through a most ingenious flexible joint directly to the drivers, allowing ample play. The other, of Oerlikon design for freight service, had its two pairs of eight drivers connected with the motors through a system of connecting and side rods, also providing flexibility. The day's trip concluded with the return direct to Milan by the special train, on which the railway company served an excellent box lunch to each guest.

UP-TO-DATE EQUIPMENT IN ITALIAN FACTORIES

An extra inspection visit was scheduled for Oct. 9 by the Società Franco Tosi to its extensive and varied factories at Legnano, near Milan. The smaller group of members and guests that gathered there received every courtesy. They saw the manufacture of steam turbines up to 10,000 kw., of Diesel oil engines up to 3,000 hp. (for submarine service 600 hp. was maximum), of steam locomotives and of waterwheels of various types, as well as the pattern shops, the foundry, the boiler shops and the forge shop, where large steam hammers of Tosi make were active. It should be noted that these shops were equipped with up-to-date tools for heavy manufacturing and that the shops did not differ noticeably from those of large American concerns. However, the absence of signs in several languages was noticeable, and I saw only Italians in the shops. The rapidity of handling traveling cranes and the skill with which steam hammers and other tools were operated attracted my attention. A beautiful new bicycle shop, operated also by the Tosi company, was visited, giving evidence of the continued demand for bicycles in Italy. Here were a number of American shop tools, such as turret lathes and automatic screw-making machines. The employment of electric furnaces was extensive. One large three-phase furnace was producing cast iron in order to maintain strict uniformity in the product.

After these visits automobiles were taken to go to a large steam generating station of the Società Lombardia per Distribuzione di Energia Elettrica, where several large Tosi turbines were in operation. Here was being installed one of the 3,000-hp. Diesel engines we had seen building at the Tosi shops. A row of four synchronous condensers with "G. E., Schenectady, U. S. A." nameplates looked like old friends in this foreign land!

In the not distant future northern Italy seems likely to become completely electrified from the Alpine "white coal." The nation has gained marked engineering ascendency, and any American engineer visiting Europe will make a serious mistake if he overlooks the accomplishments and activities of the Italians.

Electrical Research Viewed as a Career

Vast Field for Activity Open—Qualifications and Compensation—Need of Men Who Take Broad Viewpoint

BY WILLIAM SPRAGEN
Secretary Division of Engineering, National Research Council

THROUGHOUT the ages men have devoted themselves to research work. As early as the seventeenth century there were investigators in the electrical field. Gilbert, Guericke, Gray, Priestley, Franklin, Galvani, Volta, Davy, Ampère, Sturgeon, Faraday were among the pioneers. In our own times the names of Acheson, C. A. Adams, Baekeland, Behrend, Bell, Blakeslee, Carty, E. A. Colby, Crocker, Clark, Cummings, Cowles, Cutler, Campbell, Coolidge, de Forest, Dunn, Edison, Emmet, Fink, Grissinger, Hall, Hammer, Hunter, Hutchinson, Jewett, Kennelly, Lamme, Langmuir, Leonard, Lincoln, Lemp, Mitchell, Pupin, Reist, Ryan, Sheldon, Steinmetz, Weston, Westinghouse, Whitehead and Whitney are familiar to all of us.

In past times research was carried on by few, but today, as a result of education and the financial rewards of research, one can scarcely pick up an electrical periodical without finding some article relating to the subject. In the last few years particularly the appreciation of the commercial value of research has become so evident that three of the largest electrical concerns are spending annually sums that range from half a million to ten millions of dollars for this purpose.

This tremendous increase in the appreciation of research has led to a demand for research men and men trained in research ways. This demand has in turn opened up great possibilities to young men who are properly qualified to enter this field. It is unfortunate that the college man is inclined to be deterred from embarking upon such a career by the feeling that research means "finding something new" and that there is not any likelihood of *his* finding something new when so many have sought before. The correct view is to consider that research in many instances means making a thing better, replacing an ineffective process or apparatus by something more efficient, replacing rule-of-thumb methods by scientific analysis, deducing laws from experimental results, and in general finding the "why" of things.

Electrical engineering particularly furnishes a vast field for research. Each year adds to the store of vital truths and knowledge in electrical science. New and old industries find that their manufacturing apparatus and methods can be improved by electrical equipment. As it is aptly described in "The Story of Electricity," by T. C. Martin and S. L. Coles, electricity is the world's energy of all work, the ubiquitous Mercury transporting speech or written word instantaneously in all directions, the distributor of light with profuse bounty in darkened areas. It picks up the power of the cataract and delivers it, in quantities as ordered, to turn the wheels of transportation and of industry; it runs, lights and warms trains and ships; it welds metals together with a strength and firmness unapproached by many of the older methods; it aids the metallurgist and chemist, exerts innumerable good offices in behalf of hygiene and sanitation, enlarges equipment and increases the horrors of wars by its terrible military efficiency, acts as a more efficient substitute for sunlight in photography, works in horticulture, does the farmer's work, furnishes light, heat and power for homes and offices, and operates machines in every industry.

Not one of the numerous branches of electrical practice has reached the stage of completion. There is no electrical engineer in any branch of the profession, however great and effective its present condition, who would claim for it the prestige of a perfected art. Rather is it an art in which new discoveries and wider applications may be and are expected. In manufacturing organizations difficulties regarding materials and methods inevitably arise, tending to prevent smooth working. To overcome these difficulties investigation is necessary, and often when the reason why is known a complete transformation in methods of manufacture or production results. In the largest manufacturing companies there is usually a complete scientific staff and laboratory facilities to deal with such troubles. Frequently there is appreciation of the need in industry for some new tool, method or material which necessitates a deliberate search for means to satisfy that demand. Researches in pure science often result in the most important industrial gains. Moreover, research in many fields will result in the extension of the use of a particular product. Examples of present-day research problems in electrical engineering can be found on every hand.

The present-day method of attack on research problems does not imply that the young engineer shall achieve impossibilities. We have passed from the stage of the world's development in which we could depend solely upon individual geniuses for advancing the wheels of progress. The modern method is to bring together groups of well-trained, thoroughly competent men and to set before them the problems needing solution. In such an attack the scientist and the engineer work side by side.

MUST BE GROUNDED IN SCIENCE

The qualifications of the research man in the electrical field are a thorough grounding in the principles of mathematics, physics and chemistry, devotion to work, resourcefulness, absolute honesty, and the ability to reason the "why" of things. In addition to this it is necessary that the research man in any field shall have a keen power of observation and record methodically all the phenomena observed in connection with any investigation, even though at the time they have apparently no direct bearing on the subject in hand or the solution sought. Often we are unable to know beforehand all the variables involved, and although supposedly we are keeping all conditions constant except the one variable under observation, in reality there may be several other variables of which we are unable to take cognizance. The phenomena just referred to are in many cases very helpful in indicating some of these unknown variables.

In selecting any career one of the first questions we ask ourselves is: "What rewards, financial and other, are we likely to attain?" No definite figure can be set on the value of the services of the research man in the electrical field. According to his own native ability and opportunities, his annual remuneration may vary from $3,500 to several hundred thousand dollars. An average figure for the research engineer who has attained some prominence in his chosen field of endeavor is approximately $10,000, but as a beginner he may

have to content himself for a number of years with a salary ranging from $2,000 to $3,000—plus experience and training.

In a recent address before the division of engineering of the National Research Council, Professor Karapetoff of Cornell University likened the findings of researchers to dots on a chart which record experimental observations. What we lack in this country is research men of the caliber to place dots out in spaces where little is known. Organization, for which we seem particularly fitted, can fill the gaps, but it cannot place the pioneer dots. Lack of thorough understanding of scientific phenomena leads to a predominance of experimental research; consequently we have an abundant supply of men who are willing to conduct experiments, but there are few who generalize or deduce fundamental laws from experiments.

Such an understanding of scientific phenomena comes only with a fundamental knowledge of the laws of physics and chemistry. To prepare one's self for a research career it is suggested that, in addition to a course in a recognized technical school, several years be spent in the testing department of one of the large electrical companies. Whether the student acquires a sound grasp of fundamentals depends upon the man himself.

Rural Extensions on Revenue Basis

Rules Newly Promulgated by Public Service Commission Require Utility to Invest $4 for $1 of Annual Revenue—Define New Terms

EXTENSIONS on a basis of utility investment in lines and equipment of $4 for every $1 of revenue per annum are the basis on which the Public Service Commission of Oregon placed its rural service rules issued under date of Oct. 14, 1922, with the order that all present practices in the financing and constructing of electrical lines in rural territory shall in so far as they differ from the new order be superseded. The rules, which will probably receive considerable discussion in all parts of the country from those concerned in the rural-lines situation are as follows:

RULE 1. DEFINITION OF TERMS USED HEREIN.

(a) The term "consumer" shall be any person or persons, firm or corporation, who shall contract to use electricity at tariff rates for a period of at least five years and be financially responsible therefor.

(b) The term "rural district" shall include all of the distribution system built primarily to serve "consumers" located outside the corporate limits of cities and towns or other territory which has a character or density of population generally similar to urban conditions.

(c) The term "rural division" shall apply to any subdivision of a rural district receiving electrical energy through a particular primary circuit.

(d) The term "rural extension" shall mean any continuous addition to a particular rural division constructed at any one time and such subsequent additions thereto as comply with Rule 2-d.

(e) The term "utility extension unit" shall refer to that part of a rural extension constructed over utility rights-of-way.

(f) The term consumer extension unit shall refer to that part of a rural extension constructed over consumer rights-of-way.

RULE 2. COST OF CONSTRUCTION DEFINED.

(a) *Rural Extensions.*—This cost shall include all labor, material and other expense for the distribution and installation of poles, wire, cross-arms, insulators, line hardware, protective equipment and transformers (meters excluded) used in the construction of rural extensions.

Metering equipment shall be supplied by the utility and the cost of same shall not be included in the cost of the extension as used herein.

(b) *Utility Extension Unit.*—This cost shall include all labor, material and other expense for the distribution and installation of poles, wire, cross-arms, insulators, line hardware, transformers and protective equipment used in the construction of rural lines over utility rights-of-way.

(c) *Consumer Extension Unit.*—This cost shall include all labor, material and other expense for the distribution and installation of poles, wire, cross-arms, insulators and line hardware (meters excluded) used in the construction of rural lines over consumer rights-of-way.

(d) All subsequent additions to a utility extension unit costing per individual consumer the same or less than the then outstanding average cost of the original unit to which physical connection is made shall be considered as a part of such utility extension unit.

(e) Any continuous addition constructed at any one time costing more per individual consumer than the then outstanding average cost of the utility extension unit to which physical connection is made shall be considered as a separate and distinct extension unit.

(f) The net cost of increasing the capacity of existing circuits and apparatus and the cost of overbuilding of existing secondary circuits with primary circuits shall be considered a part of the cost of rural extensions in accordance with Rules 2-b and 2-c.

(g) Whenever load conditions on an existing rural division, due to increased service demands, necessitate additional line capacity on a utility extension unit in order to maintain adequate service, the additional investment shall be made as follows:

The utility shall finance the entire cost of such increase in line capacity, and for that part of the total net investment of the utility in the various utility extension units of that rural division in excess of two times the annual revenue to be obtained from such division may require all of the consumer of such rural divisions to advance such excess cost on a pro rata basis.

(h) The adoption of standards of construction which will reflect an ultimate minimum cost to the consumer shall prevail under these rules in so far as they will not conflict with the commission's rules and regulations governing the safe construction and operation of electric overhead systems. In case part of the actual construction work, hereby limited to ground work, is performed by the consumer, such construction work must be done under the supervision of the utility furnishing the service.

RULE 3. ANALYSIS OF EXTENSION.

Each utility shall, upon written request for electric service by a prospective consumer or group of consumers located in the same neighborhood, make an investigation and ascertain the number who will contract for service under the terms hereinafter prescribed, and shall estimate the construction cost as outlined in Rule 2, and shall also estimate the annual revenue to be derived from the extension.

Copy of each work-order estimate sheet showing in detail the estimated and actual construction costs to be filed with the commission upon completion of the work.

RULE 4. FREE UTILITY EXTENSION UNIT DEFINED

The utility shall finance and construct at its own expense any utility extension unit where the cost of same does not exceed four dollars for each dollar of minimum annual revenue to be obtained from such rural extension, and in cases where the guaranteed annual revenue per consumer shall exceed the minimum annual revenue the utility will be required to invest in such extention four dollars for each dollar of guaranteed annual revenue.

RULE 5. UTILITY EXTENSION UNIT ABOVE FREE LIMIT DEFINED.

If the cost of the utility extension unit required in order to furnish service is greater than the free extension cost limit specified in Rule 4, such an extension unit shall be made under the following conditions:

The utility will be required to finance and construct the entire utility extension unit, and for that portion of the cost of the extension above the free limit may require the consumer or group of consumers to deposit in advance an amount equal to such excess investment on a pro rata basis.

RULE 6. CONSUMER EXTENSION UNIT DEFINED.

The consumer or group of consumers will be required to finance the entire consumer extension unit, while the actual construction work shall be performed by the utility at the expense of the consumer. (See Rule 2-h.)

RULE 7. OWNERSHIP AND MAINTENANCE OF LINES.

The arrangement as to ownership and maintenance must be such that the title to lines and equipment in rural districts, when completed and placed in service, will rest in the utility, and the utility shall be responsible for their maintenance, operation and replacement.

RULE 8. ADDITIONAL CONSUMERS ON EXISTING UTILITY EXTENSION UNIT.

In case a prospective consumer or group of consumers along an existing extension shall apply to the utility for service, such service shall be furnished, provided such consumers shall each deposit with the utility an amount equal to the average investment per consumer then on deposit on the previously constructed utility extension unit, in addition to financing their own consumer extension unit, as per Rule 6.

RULE 9. REFUNDS TO CONSUMERS.

Within two months after the completion of each addition to a utility extension unit the utility shall refund on a pro rata basis to all consumers of such unit that part of the sum of the amount deposited by the additional consumers (see Rule 8) and the utility (see Rule 4) which is in excess of the actual cost of the additional construction.

RULE 10. CHARGES FOR RURAL SERVICE.

Regular Rates.—The regular tariff rates for rural service on file with the commission and in force at the time for any service performed by the utility shall apply under these rules.

RULE 11. ACCOUNTING REQUIREMENTS AFFECTING UTILITY EXTENSION UNIT.

(a) The unrefunded amounts of consumer deposits outstanding on rural extensions shall be shown on the utility's balance sheet, in the annual report to the commission, as a deferred credit item. This balance-sheet account or appropriate sub-accounts shall be so kept as to show separately the investments in utility extension units and consumer extension units.

(b) No consumer or his successor in the ownership of the property served shall be refunded more than the excess payments advanced under Rule 5. When all advance payments on any utility extension unit have been refunded, such extension unit will be considered as finished and no further accounting will be necessary.

RULE 12. CONSTRUCTION OF RULES.

(a) If the actual construction cost exceeds the estimated construction cost, each prospective consumer or group of consumers shall upon demand make up that difference. If the actual construction cost is less than the amount collected on the basis of the estimated construction cost, the utility shall refund the difference to the consumer or group of consumers in proportion to the amount paid by said consumers.

(b) The aforesaid rules shall not be construed or interpreted as prohibiting any utility from making free extensions requiring greater proportionate investment than above specified so long as no discrimination is practiced between consumers whose service requirements are the same or similar.

(c) If the conditions surrounding a proposed extension are such as to make it doubtful whether the business derived therefrom will ever pay a return on the investment, then and in that event, should the utility and the prospective consumer or consumers be unable to adjust the basis upon which the extension will be constructed, the matter may be submitted to the commission for investigation and determination as to the reasonableness of such extension.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Electrostatic Disturbances During Thunderstorm

To the Editors of the Electrical World:

Some time ago I made some interesting observations of electrostatic disturbances from the top of the Union Central Building during an electric storm. The facts pertaining to the observations were essentially as follows:

The Union Central Life Insurance Building is situated in the downtown portion of Cincinnati and has a height of about 492 ft. above the street. The street elevation above sea level is approximately 550 ft., so that the top of the pyramid tower of the building has an elevation of 1,042 ft. This pyramid is about 30 ft. square at the base and 30 ft. high with a walkway around the base of the pyramid.

A visiting engineer desired a bird's-eye view of the Cincinnati district, so I took him to the top of the tower during an approaching electric storm. The storm was sweeping across the ring of hills 4 miles distant, which have an elevation of between 800 ft. and 900 ft. The maximum land elevation within a radius of 15 miles from the Union Central Building is 972 ft. While at the top of the tower it was observed that there was considerable lightning accompanying the storm and that there was a pronounced sound similar to static or corona discharge which seemed to emanate from the iron-pipe lighting standards at the four corners of the tower. This sound was of varying intensity. It was weakest immediately after a lightning discharge and gradually increased in intensity until the lightning discharge occurred at the center of the storm area, 4 or 5 miles away. The time interval between the lightning discharges varied from three to six seconds.

It would appear that the potential stresses in the air are distributed over a considerably larger area than the actual storm area and that useful information might be obtained regarding the character of electrostatic charges in the air by making further observations from the tower or some similar place favorably situated.

F. D. WYATT,
Electrical Engineer.
Union Gas & Electric Company,
Cincinnati, Ohio.

Open-Car Situation in the Northwest

To the Editors of the Electrical World:

The benefit of a proper distribution of flat and gondola cars in the Northwest is not, we fear, properly appreciated by operating managers, the Interstate Commerce Commission and the American Railway Association. The few open cars now in the Northwest are being improperly distributed and given to lumber and other operating concerns which ordinarily use box cars for the movement of their commodities. The result is that the producer of Western red-cedar poles for power purposes is not able to make the deliveries which he should under existing conditions. The situation has reached a crisis.

One carload of 40-ft. poles will build 2 miles of power lines which can distribute from 10,000 kw. to 50,000 kw. of power for the benefit of every consumer

along that line. Ten carloads of poles would build a line more than 20 miles long and in certain sections distribute more energy for light, heat and power purposes than possibly ten or twenty train loads of coal would produce over a given area.

Recent articles written by Dr. Steinmetz of the General Electric Company serve to show the great saving in the distribution of power from hydraulic development and also from the development of power at the mouth of mines. The saving in transportation of coal and the conservation of our coal supply is something that every operating railroad man, the Interstate Commerce Commission and the American Railway Association should consider.

The Western red-cedar pole producer takes the position that in times like these, when cars are so scarce, a closer study of the distribution of cars to accomplish the proper distribution of fuel and of poles for power purposes is absolutely necessary. Recently a resolution on this subject was forwarded to the Interstate Commerce Commission and the American Railway Association. But very little satisfaction was had from either of these associations, simply for the reason that they do not realize that the only equipment which a pole man can use is open equipment, and, further, do not realize that a few carloads of poles is worth more to the consumer from a power distribution standpoint than many trainloads of coal which will be used inefficiently.

It is to be hoped that publicity will bring to the attention of the proper authorities the necessity of a correct distribution of open equipment in the interest of shippers and power consumers.

E. L. CLARK,
President.
Valentine-Clark Company,
Spokane, Wash.

"The Fused Neutral"

To the Editors of the Electrical World:

Recent correspondence on this subject in your paper tends to promote a "safety first" movement in the business of housewiring. Codes, where the final supply voltage is 220 and more, are rather emphatic about the neutral not being fused from the power house up to and including the house-service cut-out on the consumer's premises. Further, so far as the power house and substations are concerned, the neutral may not be disconnected even for a test except at a certain prescribed hour after midnight.

Danger to life where there is a standard supply voltage of 110 is limited to very extreme cases such as a person being wet or otherwise lacking the insulating properties of a healthy skin. It is the consumer's apparatus and contiguous property that are exposed to injury, as may be seen from the example of a ten-apartment house. In this case the supply is taken as being three-wire, direct-current, and it is assumed that the ground-floor apartments, fitted with advertising signs, etc., are shops, one of which has closed for the night, causing a temporary "out-of-balance," as shown in Fig. 1.

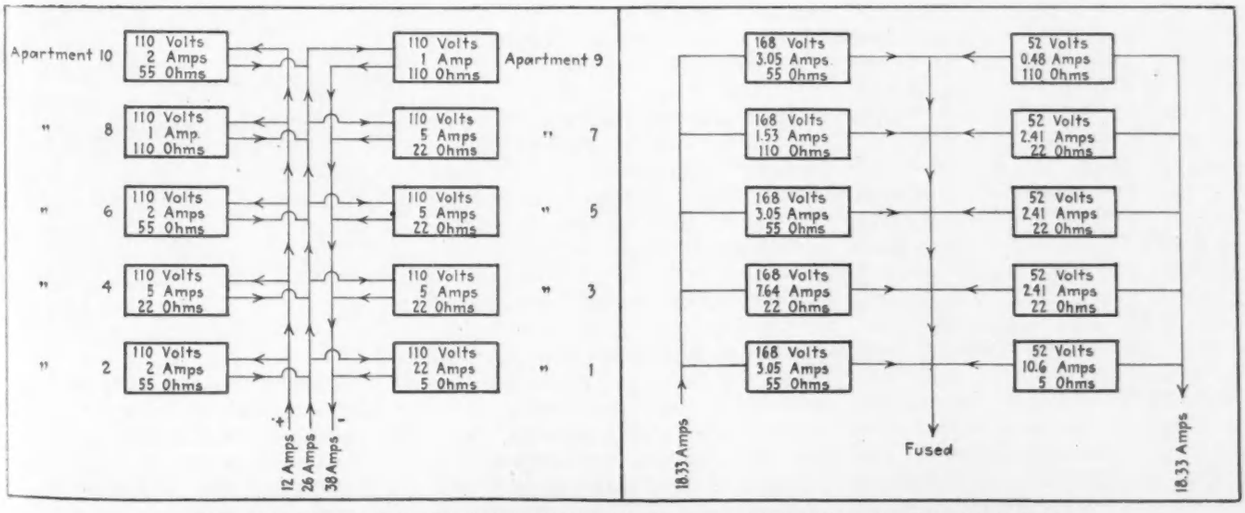
The neutral fuse blowing at this moment produces the effect illustrated in Fig. 2, which is merely Fig. 1 simplified, with the new conditions of current and voltage inserted as obtained from the series-parallel resistances and a simple application of Ohm's law. The comparatively small resistance of the wiring has not been considered.

The strain on both apparatus and insulation on the lightly loaded side is apparent without further elucidation. What aggravates the situation more than ever during an occurrence of this kind is the ignorance of the consumers on the other side, who, finding their lights very dim, promptly proceed to switch on others that may be available.

Code or no code, there is probably not one utility undertaking that does not "link" all neutral cut-outs, or otherwise bridge them with wire, out of all proportion to relative fuses in the "live" wires. The question is how we may apply the practice to consumers' circuits to the best advantage.

All codes and insurance regulations seem to choose the lesser of two evils in their insistence upon fusing equally both conductors of each circuit. A correctly selected fuse in one conductor of each circuit gives that circuit ample protection against short circuits. It will also act if the "live" wire gets grounded, but the neutral may develop a solid ground connection without having the least effect on the fuse; and as the consumer's bills too will not be affected, this grounded neutral with its attendant electrolytic action will go on unperceived until some worse damage than a local burnout has been done to the property so far as its metallic structure and piping are concerned.

L. H. B. SANDWELL.
International General Electric Company, Inc.,
Schenectady, N. Y.


Apartment 10
110 Volts 2 Amps 55 Ohms
110 Volts 1 Amp 110 Ohms
Apartment 9
" 8
110 Volts 1 Amp 110 Ohms
110 Volts 5 Amps 22 Ohms
" 7
" 6
110 Volts 2 Amps 55 Ohms
110 Volts 5 Amps 22 Ohms
" 5
" 4
110 Volts 5 Amps 22 Ohms
110 Volts 5 Amps 22 Ohms
" 3
" 2
110 Volts 2 Amps 55 Ohms
110 Volts 22 Amps 5 Ohms
" 1
+
12 Amps
26 Amps
38 Amps
-
168 Volts 3.05 Amps 55 Ohms
52 Volts 0.48 Amps 110 Ohms
168 Volts 1.53 Amps 110 Ohms
52 Volts 2.41 Amps 22 Ohms
168 Volts 3.05 Amps 55 Ohms
52 Volts 2.41 Amps 22 Ohms
168 Volts 7.64 Amps 22 Ohms
52 Volts 2.41 Amps 22 Ohms
168 Volts 3.05 Amps 55 Ohms
52 Volts 10.6 Amps 5 Ohms
18.33 Amps
Fused
18.33 Amps

WHAT HAPPENS IN AN UNBALANCED THREE-WIRE SYSTEM WHEN THE NEUTRAL FUSE BLOWS

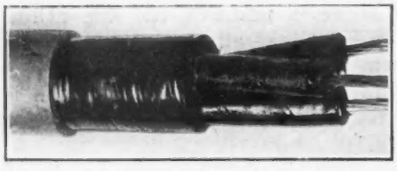
Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of
Economically Utilizing Electrical Energy

High-Tension Line in Mine Shaft Reduces Loss

SUPPLYING motor-driven pumps for "dewatering" a mine from an 11,000-volt substation at the 1,700-ft. level of a 2,000-ft. shaft satisfactorily solved the problem of increased power demands and overcame the high distribution losses of the former low-voltage system. The old system utilized 440-volt feeders to the pump motors from a substation at the collar of the shaft.

The installation now in service for



STRIPPED CONDUCTORS AND METHOD OF INSULATION OF MINE SHAFT CABLE

dewatering consists of one steam plunger pump delivering 1,500 gal. per minute and nine motor-driven centrifugal pumps varying in capacity from 125 gal. to 2,200 gal. per minute. These all pump into a drain tunnel at the 1,500-ft. level. The steam pump is on the 1,700-ft. level and is used only in emergencies. The larger electric pumps are set in pairs on the 1,700-ft. and 2,000-ft. levels and are operated as required by the flow of water. Electric power obtained from the Utah Power & Light Company at a potential of 11,000 volts was originally transformed at the collar of the shaft and taken underground at 440 volts. The increasing power demand and the high loss in transmission through the wet shaft suggested the installation of a high-tension transmission line, with the transforming and distributing done on the 1,700-ft. level.

The cable used was a three-conductor No. 4 AWG strand, each conductor insulated with $\frac{6}{32}$-in. varnished cloth, with the three conductors bound together with $\frac{6}{32}$-in. varnished cloth and $\frac{1}{8}$-in. plain lead sheath over all. The stripped conductors and the method of insulation are shown in the accompanying illustration. Before delivery the cable was tested for five minutes at 40,000 volts both between conductors and from the conductors to the lead sheath. To facilitate shipment and handling at the mine it was delivered in three sections.

In installing the cable a $\frac{3}{4}$-in. plow-steel, blue-center messenger rope, wound on the drum of the hoisting engine, was fed over a sheave wheel into the shaft. A ball weighing about 150 lb. was attached to the free end of the rope. At the collar of the shaft the cable itself was clamped to the messenger rope at 5-ft. intervals and lowered. When the first section of the cable was in place it extended from the 1,200-ft. to the 1,700-ft. level. At the 1,200-ft. level the messenger rope was anchored, and the remainder was cut and hoisted to the surface. The second section of the cable was now clamped to the messenger rope, lowered and anchored at the 600-ft. level. In a similar fashion the third section was placed and anchored at the collar of the shaft. As a result the entire cable is carried by three independent lengths of messenger rope, supported at three places. Pothead connections were employed in joining the ends of the cable sections together.

The cable was carefully inspected throughout the entire length of the shaft, and extra lead sheathing was wrapped around it at all points where it touched the timbers and other transmission lines.

On the 1,700-ft. level a concrete fireproof chamber was constructed to accommodate three 150-kva. transformers, reducing the 11,000 volts down to 480 volts for distribution. Cooling of the chamber is accomplished by a sucker fan electrically driven.

Lightning arresters were erected at the collar of the shaft, where a control switch was placed. This switch can be opened by means of a push-button near the transformers.

The crew installing the cable averaged nine men per shift and consisted of one electrician, one man drawing the cable and the messenger rope, one man unwinding the cable reel and marking the clamp positions, four men clamping the cable to the messenger rope, and two men following the cable down the shaft, keeping it clear from obstructions. Mining operations were suspended for three days during the installation of the cable. Considerable difficulty was met with in avoiding obstructions in the shaft.

C. M. BURTON,
Mining Engineer.
Ontario Silver Mining Company,
Park City, Utah.

Pipe-Line Cradles Replaced During Service

THE decayed condition of the wooden cradles and sills on the wooden stave pipe line of the Northwestern Electric Company has made it necessary to replace approximately 1,200 cradles at its hydro-electric plant on the White Salmon River in Washington. This pipe line is 13 ft. 6 in. in diameter, 4,987 ft. in length, and is supported on wooden cradles set on wooden sills. The wooden sills and lower cradle ties have decayed

FLEXIBLE METAL PIPE USED TO POUR CONCRETE SILLS FROM NARROW-GAGE TRACK

and are being replaced with wooden cradles on reinforced-concrete sills. As some of the cradles were in worse condition than others, it was necessary to replace them in the order of their respective deterioration.

In order that this might be accomplished economically, it was necessary to provide equipment which could be readily moved from point to point. A concrete mixing plant was located at a central point directly on the pipe line where all material could be supplied by gravity chute from a nearby road. A 24-in. gage track with 4-in. x 4-in. fir rails protected with strap iron was laid on top of the pipe line for its full length. A 3-hp. motorboat engine provides the motive power for the concrete dump car shown in the accompanying illustration. This motor is capable of pulling the two dump cars used on the job at a speed of from 3 miles to 4 miles per hour and in addition handles all cradle material. Two hoppers with "elephant trunks" were constructed for handling the concrete.

The "elephant trunks" were made of sectional iron pipe to conform to the curvature of the pipe line so that the concrete could be placed in the forms without the necessity of hoeing or shoveling. This equipment is provided with removable dolly wheels which can be easily attached and the whole apparatus towed with the gasoline motor from one location to another. Portable forms are used for the concrete sills, which are 18 ft. x 12 in. x 18 in. and are reinforced with steel bars.

An average of eighteen sills per week is poured, which indicates rapid progress considering the occasional long moves.

E. F. PEARSON,
Electrical Engineer.
Northwestern Electric Company,
Portland, Ore.

Changing from Coal to Oil in Record Time

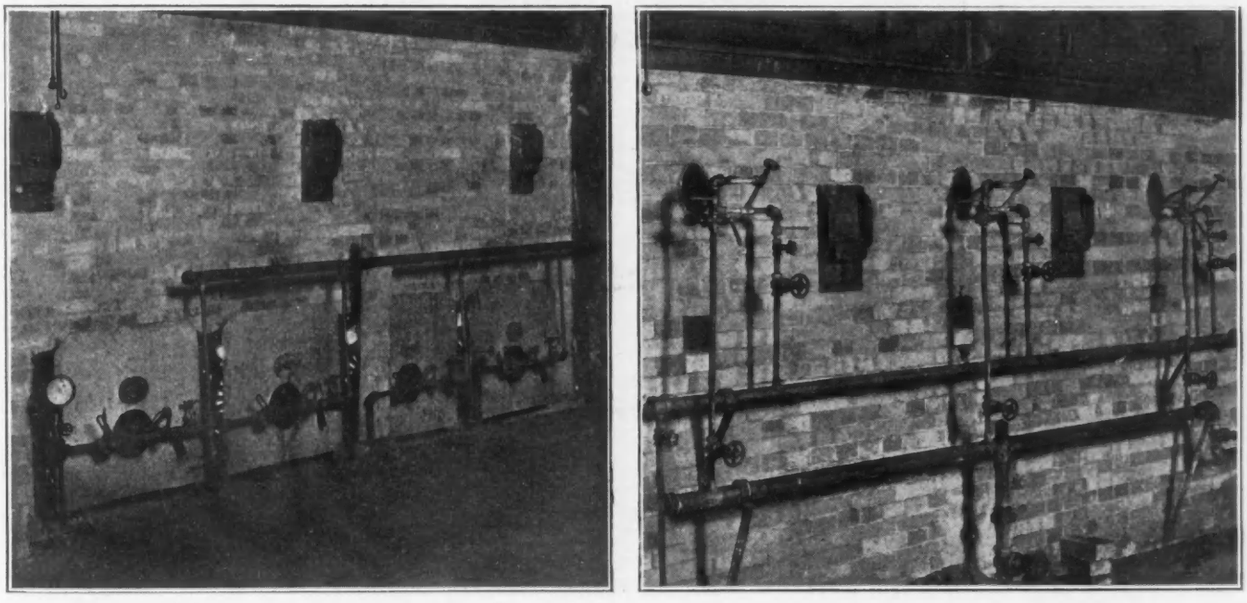
On Sept. 1 It Was Decided to Make the Alteration in Equipment, and Twenty-six Days Later the First Boiler Was on the Line —Barge Used as Floating Storage Tank

TO AVOID any possibility of a coal shortage tying up its electrified lines in and near New York City, the New York Central Railroad recently decided to change several of its boilers in its Yonkers power house so that they would burn fuel oil. Twenty-six days after this decision the first oil-fired boiler went on the line, although no tanks, heaters or pumps had been installed.

The installation was made not only to conserve coal but also to gain the practical information needed for use should a more serious emergency arise. The experiment has shown that under the conditions prevailing in water-front locations in the New York district it is possible to overhaul stoker-fired boilers and put them back on the line ready to burn fuel oil in less than four weeks after the change has been decided upon. In view of the fact that the average power plant normally keeps coal on hand for three or four weeks' operation, this demonstration should be reassuring to engineers confronted with the possibility of a coal shortage.

The work involved rebuilding the settings of six Babcock & Wilcox boilers equipped with Roney stokers, including the installation of steam jet burners. Of the six boilers now operating on fuel oil, four are equipped with Enco burners, there being four burners to a boiler, and two have Hammel burners, three to a boiler.

An 8,000-bbl. oil barge fully loaded with 14-16 Baumé light Mexican topped crude oil was obtained for an indefinite period as a floating storage house and was tied up to the dock alongside the plant. Steam was carried from the plant through a 2-in. flexible connection to the barge, where it passed to the oil-heating coils and to a small simplex oil pump, both the coils and the pump being part of the permanent equipment of the barge. Another flexible connection ran from the pump discharge to the oil main, which projected through the wall of the boiler-room basement. After being heated to 160 deg. F. in the tanks of the barge, the oil was forced into the main by the simplex pump. The pressure of 80 lb. per square inch at the pump allowed the burners to operate at 75 lb. per square inch. A steady flow of oil was maintained considerably in excess of that required by the burners, the portion not used coming back to the dock through the return side of the main and passing to the barge tanks through a flexible connection. This excess flow was necessary to prevent the oil from cooling below



OIL BURNERS AT YONKERS POWER STATION OF NEW YORK CENTRAL RAILROAD FED FROM BARGE ALONGSIDE PLANT
Four of the six boilers now equipped for oil burning use the type of burner shown at the left.
The other two use the oil burners shown at the right.

a workable temperature. The procedure described was followed before the inside tanks were installed.

As the inside equipment is now in operation, the oil is pumped directly from the barge to three tanks, each of 2,500 gal. capacity. These are in the basement of the station and will soon be surrounded with a concrete wall 12 in. thick. The space between the tanks and the wall will be filled with sand to reduce the fire hazard. After being heated from 160 deg. F. to 180 deg. F. by thermostatically controlled coils submerged in the tanks, the oil gravitates through a twin strainer to a pair of 7½-in. x 5-in. x 6-in. duplex pumps connected in parallel. These force it through a heater where its temperature is raised to 190 deg. F. before passing to burners.

As no outside storage space, aside from the barge, has been provided, it will be necessary for the present to keep the barge tied up to the dock whenever fuel oil is burned, replenishing the supply from time to time from other barges. If operation with fuel oil is continued, two 30,000-bbl. tanks may be installed outside the power station, probably on a foundation made by driving piles and building up land in the docking space that is located on the river side of the station.

These changes were supervised by the electrical department of the New York Central Railroad under the direction of E. B. Katte, the chief engineer of electric traction.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Improving the Operating Log of a System

TO MAINTAIN some degree of accessibility in the matter of approximately 20,000 items comprising the operating log developed a problem that caused one central-station company to abandon the system of log records which had been in effect for seven years—during which time the business handled, as evidenced by the log entries, had increased 200 per cent—and adopt a scheme that was more nearly self-indexing and not as complicated as the former method.

In this company the official operating log is kept in the office of the system operator, from where the operation of the whole generating, transmission and distribution process is directed. All work on operating equipment is handled through a system of permits issued by the system operator. Such work and the proper blocking of the apparatus to permit it are carefully followed up. A separate permit is made out in duplicate on each job and for each separate crew working on the apparatus. One copy is filled out by the system operator who issues it and is entered in the log together with a brief history of the work. The other copy is made out at the place where the work is done and, when signed by the workman and by the operator in charge there, is forwarded to the system operator. Prior to the rearrangement in the record system the two copies of the permit were filed in numerical order in the office for a short time and then destroyed, the item in the log being the official record.

Of the estimated 21,000 items in the log for the year 1921, 12,000 were permit items. It was here that the efforts at reform were directed, for these 12,000 log entries represented only half the clerical labor entailed on the part of the system operator in giving out the permits, since the permit form itself first had to be filled out in every case. The loose-leaf ledger type of log book is employed, as many sheets being used per day as are required. A special form of log sheet was designed to replace the system operator's copy of the permit. The forms of eight permits were laid out on a log sheet, front and back together, four to the page, as shown in left form of Fig. 1. With this scheme the system operator had only one form to fill out. The permit sheet was filed in the ledger following the regular log sheets at the end of the day, after a memorandum had been taken concerning each permit still outstanding by reason of the work on it being uncompleted. This scheme still meant numerical and chronological filing of the permits, and because of the great number of them some form of index was necessary to keep them available.

The system finally adopted was that of making the permit itself the official record, dispensing entirely with the permit entry in the log, permanently filing the permit slip ac-

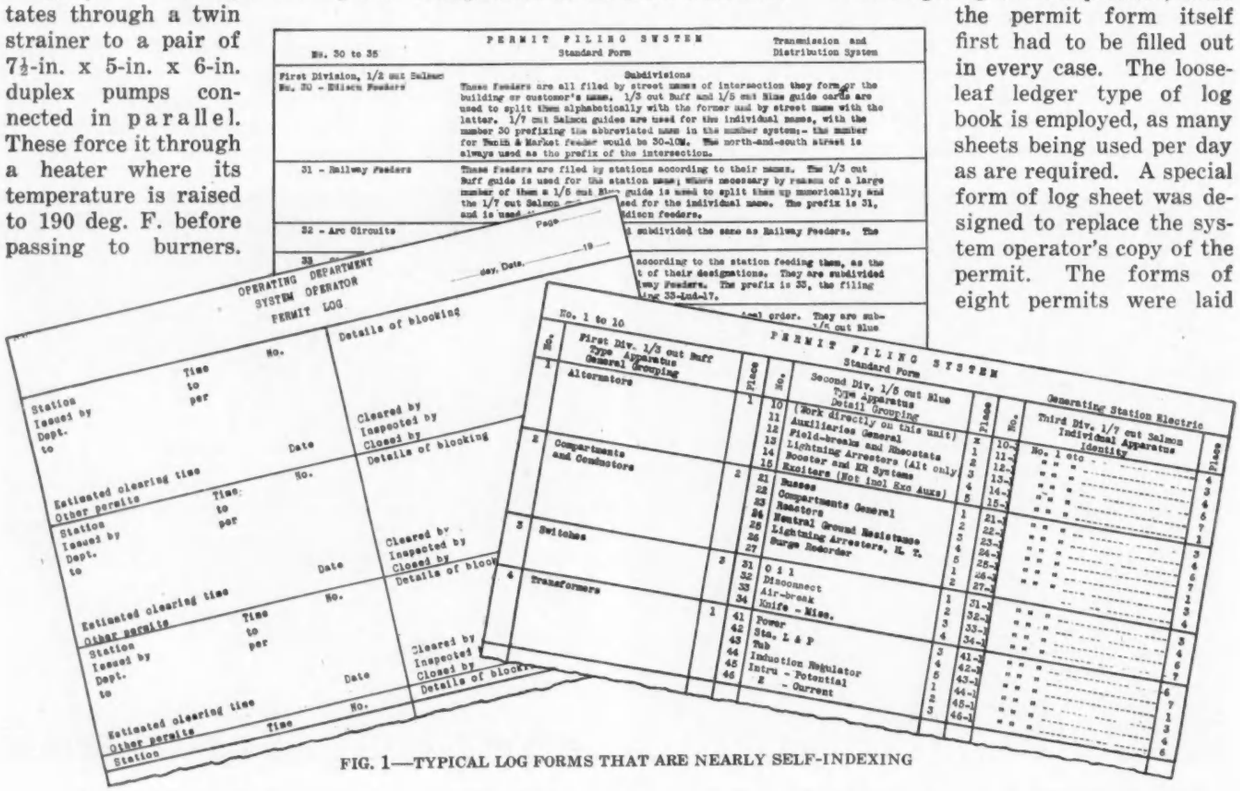


FIG. 1—TYPICAL LOG FORMS THAT ARE NEARLY SELF-INDEXING

cording to station and apparatus regardless of chronology and serial.

The permit file consists of two sections—the station section and the transmission and distribution section. In the former all stations are arranged by name in alphabetical order irrespective of class of service. Transmission lines are filed by number and distribution lines by name. A standard form of divisions and subdivisions, shown in the two other forms in Fig. 1, was worked up and so designed that the same kind of apparatus would always have the same relative position, with the same kind of index guide card, in every part of the file. The file is laid out according to type of apparatus, as much of the layout as needed being repeated in each station. Each station, therefore, can form in itself a complete file of standard layout. Each division and subdivision has been given a number as well as a name, and the file is so indexed, both number and name appearing on the guide cards in the manner shown in Fig. 2. At the top of each permit as issued is noted its filing destination. Sometimes this may embrace several words. Referring to Fig. 1, it will be seen that 13-6 would be equivalent to "Alternators—lightning arresters —No. 6 unit."

The schematic layout is the secret of the success of the file. The number of filing places is limited because extensions can be made only as prescribed, hence there can be no private pigeonholes to suit the notions of the individual operators. It is automatic, the outline stating definitely where each type of work must go. Growth according to plan is possible at every part of the file without affecting any other part.

Indexing the various entries in the log is a difficult but essential task. Some classification and reference to the 9,000 assorted items added yearly to the record is necessary. When a report on the action over a period of time of some certain unit in the equipment, or on the quality of service supplied to or from some branch of the system, is wanted, if the whereabouts of the desired information is not indicated in the index, it will be found only through a careful search of every page of the log book over that period.

The index that was in use consisted of a set of sheets in the log book for each month on which all major operating events were classified and made the headings of columns wherein were noted the dates on which each such event had an entry in the log. The permit file now in use offers a much more flexible means of indexing. A card containing the index notes placed immediately in front of the permits for any line, station or unit of apparatus is instantly available and in addition contains all the data for that particular line, station or unit. To obtain the same information from the older index would entail consulting the separate sheets for each month over the period wanted and searching the entire column of any classification to get the items relating to the particular unit concerned. Furthermore, the sheets are always limited to the number of subjects listed in the column headings.

The change in method of filing the permits overcame the necessity for indexing any longer those items on which permits were taken out. This effected quite a saving in clerical work, as the only items that did not always have permits were interruptions, switching errors, storms and unusual operating conditions. The interruptions are noted on the cards for the individual lines and circuits or the customers' substations. Switching errors and serious station interruptions are entered on the cards of the stations. Storms and unusual trouble are grouped for the system. In the absence of a permit stating so, a card is made out on new apparatus showing the date it is put in service.

Since the system operator's office must function impersonally and the man on the job at any time must be fully conversant with everything going on, there is occasion for the writing of innumerable memoranda concerning happenings not in the scope of the log, arrangements for work more or less distant, changes in plans and what not. Most of these are soon destroyed, but many have a permanent value. The permit file offers a receptacle to keep them out of the way and at the same time instantly at hand.

One of the greatest values of the file is the facility it affords for consistency in operating practice. Different men will have different methods for accomplishing the same results; but while all may be equally effective, the impression left with those dealing with the system operator will be more favorable the more consistently his office functions. Standardized operating methods are best. With his ready access to all the permits issued by his office he can immediately determine the method employed in handling any job on previous occasions and so be guided in his procedure.

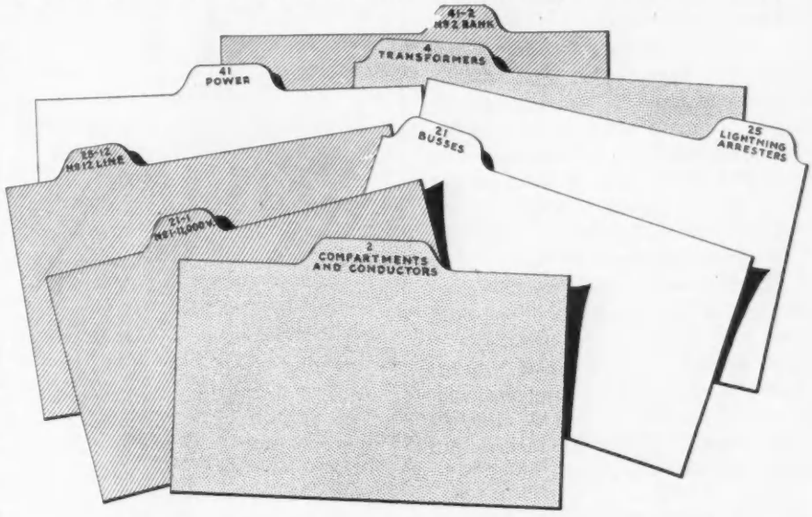


FIG. 2—GUIDE CARDS USED IN FILING FORMS SHOWN IN FIG. 1

Camden, N. J. FRANK GILLOOLY.

Value of Local Repair Shop for Generating Plant

LOCAL repair shops in large generating stations afford means of securing economical repairs which should not be overlooked, according to Frank M. Lucas, assistant chief operating engineer Narragansett Electric Lighting Company, Providence, R. I. Failure of parts not in stock necessitates the making of such parts at once, and this time element makes a local shop imperative.

When emergency repairs are sent outside to local shops it has been found very difficult to impress those

in charge with the gravity of the repair situation from the central-station standpoint. The work must be speedily and yet accurately machined. Transportation must be provided and someone detailed to remain with the job until it is completed. Instructions relative to the amount of turning to be done in certain classes of repair work are essential and delays sometimes have arisen through the failure of outside shopmen to remember these. Sometimes the cost of outside work is greatly increased by the fact that the shop may be steam-driven, necessitating keeping on the job at overtime rates firemen, engineers, shop superintendent, general foreman, gang foreman, machinist and helper, with truck driver and other transportation charges and delays. To overhaul a 24-in. throttle valve required thirty hours in an outside shop compared with eight hours in the South Street station shop after the latter had become established. In another case a new thrust-collar lock nut was made at the plant shop in one and one-half hours. Had this been sent outside it would probably have taken many hours and resulted in the shutting down of a turbine needed on the following Monday, the nut failure occurring on a Saturday.

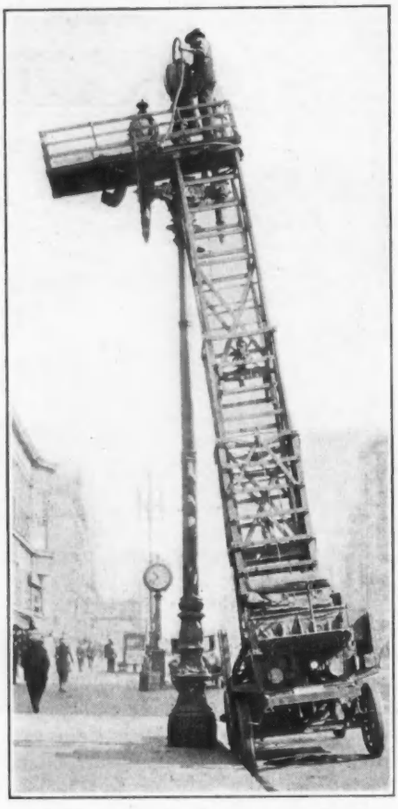
SHOP OF GREAT ADVANTAGE DURING CONSTRUCTION PERIODS

During the installation of fuel-oil burning equipment and of a recent new turbine unit the proximity of the machine shop to the new work was of inestimable value in connection with the fitting and adjustment of new parts. Numerous regulators, rams, furnace parts and valves have been produced in connection with devices to improve plant efficiency. Three machinists are constantly employed reseating valves, making new stems, glands and nuts, repairing oil-burner parts, making special pins and bolts and reversing boiler, pump, fan and other parts. In a word, the shop is "open house" to all repairs from mop wringers to turbo-generators. The present machine tool equipment consists of three lathes (30, 16 and 14-in.), one 24-in. shaper, three drill presses, one power saw and emery wheels. This particular shop is at the South Street generating plant of the Narragansett company, which has a rating of about 120,000 kw., including two 45,000-kw. turbo-generating sets and several smaller units. The total number of machines in the plant, including auxiliaries, is about 100, each having an average of about 700 parts.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Tower Truck Cleans Street Lamps with Vacuum

A COLLAPSIBLE tower mounted on an electric truck is used by the Pacific Gas & Electric Company for trimming the luminous arcs in the "Path of Gold" on Market Street, San Francisco. The uppermost lamp is about 35 ft. above the sidewalk,



VACUUM CLEANER ON 30-FT. TOWER TRUCK CLEANS ARC LIGHTS

and it was necessary to have a type of trimming device which would enable a man to work on the lamps safely and quickly. The idea of the tower truck shown in the accompanying photograph was suggested by the shorter tower used by street-railway companies for working on overhead construction. It was only necessary to add one more collapsible section to make a three-section tower that would have a maximum lift of 30 ft. The tower is mounted on a 1½-ton electric truck and is provided with a platform mounted on a turntable so that it may be turned in either direction. The 110-volt battery which drives the truck is also used to operate a motor for raising and lowering the tower. This motor is started by pulling a rope which may be reached from the working platform to raise or lower the tower, automatically stopping when the limits have been reached.

For cleaning the lamps an ordinary household vacuum cleaner, driven from the battery on the truck, is mounted on the under side of the working platform. By means of a rubber hose attached to the cleaner the magnetite dust and particles are drawn from the lamps. A circuit from the battery is used to test the lamps after they have been trimmed. The truck travels about 4 miles a day and uses from 80 amp.-hr. to 120 amp.-hr. Each day thirty-six lamps are trimmed and eighteen cleaned in addition to repairing any lamps that may have been reported "out." The use of this truck has been so successful that a second one has been built.

A. J. THEIS,
Superintendent Overhead Department.
Pacific Gas & Electric Company,
San Francisco, Cal.

Defects Which Engineering Inspection Disclosed

EXAMPLES of "how not to do it" occasionally have value to the operating man, and a list of sins of omission and commission revealed by an engineering study of a small central-station system of overhead lines may at least serve as a guidepost to that small percentage of companies which fail to heed the signs of the times and put their electrical households in order. Some of the things disclosed are:

Primaries run on bottom instead of top cross-arms.

Overhead lines run in unsatisfactory and indefinite arrangement.

Distance between primary wires on poles 12 in. instead of 28 in.

Primaries and secondaries frequently attached to same arms.

Plant shut down when making line repairs.

Primaries attached to houses by strain insulators.

Rotten cross-arms which would not hold bolts were tied with ropes.

Rope suspension of 2,300-volt wires from pole.

Insulators nailed to cross-arm on pole.

Lack of strain insulators in guy wires.

A run of 1,000 ft. mill service, primaries, used No. 10 copper.

Power wires laid upon pine arms without insulators.

Primaries run on small porcelain knobs nailed to a chimney.

No. 10, No. 12 and even No. 14 wire used to carry primary service to house transformers instead of No. 6.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Promotion of Rural Business*

Can It Be Developed Without the Imposition of an Additional Burden on City Business?—Need for Discretion in Taking on the Many Grades of Farm Customers

By R. B. King
General Superintendent Idaho Power Company, Boise

THE cost of serving rural business is obviously greater on the average than that of city business. The question, then, resolves itself into that of the prospective rural customer paying the excess cost or the city rates being higher than they otherwise would be.

There are all grades of rural business, varying from the outskirts of cities, nearly as dense as the city itself, to the more remote districts with from no houses to six houses to the mile; also, from the rapidly growing district that is sure to increase steadily in density to the district doomed to all appearances to remain forever in its present condition—or worse. There is no doubt some rural business within the reach of every utility company that can be developed profitably, where the prospective consumers are not only willing but able to pay the excess cost during the period of development, but there is need for the use of discretion in handling applications or soliciting business requiring extensions into rural territory.

Two Plans Have Prevailed

Two general plans of meeting this situation have been more or less tried out in practice:

First, to let the prospective customers build, own, operate and maintain the necessary distribution lines, and sell power to them at wholesale from some suitable point of delivery on the utility company's system. This plan has been worked out with apparent success in some localities, and conditions do exist where it seems much the better plan. It seems to have the advantage of eliminating service complaints and of getting the individual consumer to do willingly for his local organization many things he would not do at the request of a public utility company.

Second, to adopt an extension policy where the prospective rural customer may obtain service by paying the cost of that service. Such an extension policy has been one of the big problems before utility companies during the last few years, and the matter became particularly acute when construction and maintenance costs went skyward during and after the war period.

Many different forms of extension rules have been devised which attempted to express this policy in workable form. Whether or not a quality of workableness is attained, they are all based upon the fact that excess cost in connecting and serving new customers does impose an additional burden on somebody, and the rules attempt to specify the necessary adjustments to relieve the present customers and place the excess burden upon those directly benefited. The adoption of such an extension policy seems to be the solution of the problem in all districts that have prospects of immediate growth, where it is reasonable to expect that within from five to ten years the business will have developed to approximately the average density of the system as a whole.

Correct Extension Rule Needed

Under these conditions a reasonably accurate estimate of the excess carrying charges for the average development period can be made and service furnished with equity to both old and new customers. It is, then, a question of the correct extension rule, which is as yet an unsettled question.

In general, the more detailed and exact the adjustment attempted, the more complicated and unworkable the rule becomes, and to be practicable a rule must be based on general averages. It must, also, be based on an assumed development period and an adjustment to cover the entire period be made at the start and in advance of construction.

There is throughout the Northwest, however, a great deal of territory with a different future ahead of it, territory with no prospect of developing to the average density of the system and no prospect of being supplied with electric service except at considerably higher cost than the general average. This is what may be called permanent rural territory. It seldom is cut by public highways into less than half-mile squares, with a maximum of from eight to ten customers per mile of line, and service is supplied by means of primary distribution lines and separate transformers for each customer.

Cost per Mile

Lines suitable for this class of service can be built for about $1,500 per mile, and the transformer, meter and service installation will average $95 per customer. With ten customers per mile the investment per customer will be $245, or an annual investment cost of $29.40. The annual operating, maintenance and customer costs will be appreciably higher than for urban business and will average at least $20 per customer. With power costing $50 per kilowatt-year at the substation, the total cost in this case will be $49.40 per customer plus $50 per kilowatt of the average simultaneous demand at the station.

The demand in this kind of territory, particularly in dairying districts, is liable to be more per customer than in urban business. Assuming 1.5 kw. as the average demand per customer at the substation, the annual cost will be $125 for this rural territory. If the rural customers can be induced to do enough of their work electrically to give them a load factor of around 20 per

*Abstract of a paper presented before the Northwest Electric Light and Power Association, Boise, Idaho, June 7-10, 1922.

cent, or an average consumption of about 250 kw.-hr. per month, they will then be profitable and self-supporting customers at an average rate of 4½ cents per kilowatt-hour.

This means a fairly free use of ranges, small motors and other appliances and an average monthly bill of $10.40 per customer for all service, and it is an unusually thriving community that can maintain that average. It is, therefore, quite evident that rural business will impose some additional burden on other customers, unless a higher rate is charged, and the adoption of a higher rural rate for the purpose of adjusting the burden in accordance with the cost often falls farther short of accomplishing that purpose than uniform rates would do.

How much higher the rural rate should be depends upon where its application begins, and drawing the rural rate line appears to be a process more arbitrary than equitable. Some of the costs are more easily segregated than others. The customers' costs furnish the clearest case, while the segregation of distribution, investment and operating costs is arbitrary in nearly all cases.

DRAWING THE LINE

The nearest to a workable plan seems to be the assembling of excess customer costs into a so-called rural charge to be added to the regular city rate. This, however, lends no aid in the drawing of the line. In some localities the line may be plainly marked by conditions, but in many others it must be purely arbitrary, so gradually do the urban and rural territories merge one into the other.

The benefit from this kind of relief to cities at the expense of the rural communities is also very questionable. The amount of relief to the average city customer is obviously small in proportion to the burden placed upon the average rural customer, and it is probable that a thriving condition of the rural territories is of greater value to the city customer than would be his assessment through the operation of uniform rates.

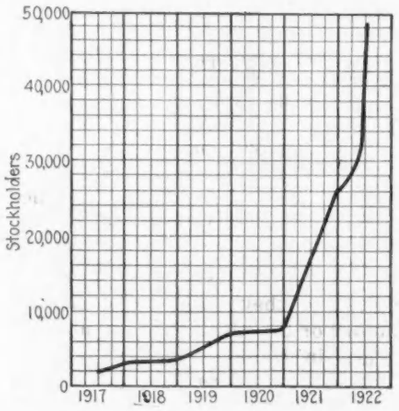
Special cases will always be found, of course, requiring special treatment, but in general, it being admitted that the development of rural business will always impose an additional burden on somebody, a reasonable limit should be fixed up to which the company will assume the cost of furnishing service and spread such cost over all business. Beyond that reasonable limit, where future growth is sufficiently assured to warrant the fixing of a development period, an advance adjustment should be made whereby the carrying charges on the excess cost will be paid by the prospective customers. Territory where the cost of service is beyond the reasonable limit, and where the conditions indicate no prospect of immediate growth, should be furnished with wholesale power wherever the residents are able to perfect an organization to supply their own distribution system.

A Public Utility with 48,000 Partners

Remarkable Progress in Southern California Edison Company's Aim to Make Every Customer a Stockholder—How the Sales Plan Operates

BY A. N. KEMP
Vice-president Southern California Edison Company, Los Angeles

THROUGH the operation of customer ownership the Southern California Edison Company, in a period of five years, has increased its stockholders from approximately 1,800 in 1917 to more than 48,000 in 1922. Probably the greatest single factor in the success of this campaign has been the policy of the company first to make every possible person in the territory served a partner in the business. The idea of raising new capital, while highly important, was of secondary consideration. The results accomplished have been obtained almost solely through the intense co-operation of the 4,000 or more employees of this great central-station organization.



INCREASE IN STOCKHOLDERS FROM YEAR 1917 TO 1922

The plan had its inception in 1917 when the properties of the Southern California Edison Company and the Pacific Light & Power Corporation were merged. The officials of the company foresaw the benefits of having the ownership of the company remain in local hands and decided almost immediately to put the customer-ownership plan into effect.

The campaign was launched in August of that year, the first step being to hold a number of meetings at the company's various branch offices, at which time a plan whereby the employees might purchase stock on easy installment payments was explained in detail. The terms offered to employees were such that within a very short time more than 75 per cent of them had become partners in their company's business to the extent of several million dollars. Now more than 4,300 employees, or 98 per cent of the permanent force of the company, are shareholders and are purchasing better than $5,000,000 (par value) of Edison common stock. The plan permits them to purchase stock through payroll deductions of 75 cents per share per month. They are credited with the full dividends on the stock, which at the present time yields 8 per cent on the par value, and they are charged 6 per cent interest on the deferred payments. In actual practice it figures out that for every dollar an employee pays on his stock contract the company adds approximately 20 cents.

Before the company started the sale of stock to the general public a further series of employee meetings were held at which the whole plan of campaign was outlined and literature, descriptive booklets and order blanks were explained in detail. Thus when the first campaign was opened by a series of newspaper advertisements throughout southern and central California the company had several thousand men and women thoroughly familiar with the value of the security and who could answer any ordinary question that a prospective customer might put to them.

As will be noted from the accompanying chart, the selling period covers five years, but in the latter part of 1917 and the year 1918 the company retired from the field so as not to interfere with the various

Liberty loan campaigns which were running at that time. In this period there was sold to the public $28,442,800 par value of stock and to officials and employees $6,993,600 par value. In all, a total of $35,436,499 par value of stock has been sold at average sales cost of $1.05 per share. As the result of loyalty of the employees to their company and intensive sales effort, in June, 1922, in one week's time, virtually $2,500,000 worth of common stock was sold to more than 11,000 new subscribers. This particular drive for stockholders was put over by the Edison organization as a compliment to their president, John B. Miller, and was named the "John B. Miller Week."

SALES METHODS

A number of sales methods have been tried and all have produced results. It is difficult to say which particular method was the most successful, but a general outline of the sales policy may be of interest. Where the sale of stock is conducted through the agency of the employee the first consideration is to have as large a number of employees as possible as stockholders in the company. Secondly, they must be thoroughly "sold" themselves on the merits of the securities they are offering to the public.

This was accomplished through a series of meetings at which all employees and department managers attended, where they were thoroughly grounded in the main talking points of the security. Next, quotas were set for each district served by the company and each department of the organization for the number of new stockholders to be secured for the year. It was thus put squarely to each employee that he would be held responsible for obtaining his share of the quota for his particular department. A series of charts are kept in all of the departments with the names of the employees, showing the results of their efforts day by day, and a monthly report is sent to every employee on the system showing the results obtained by districts and departments. A sales force of approximately thirty men was used, one to each geographical district, whose duties were not only to obtain new stockholders themselves but to assist the other employees.

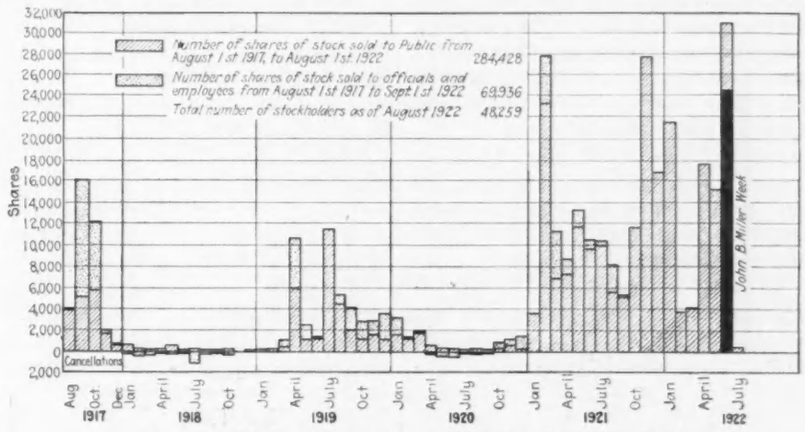
While the several campaigns were on the employees were helped by advertising in all of the newspapers in the larger cities and in the country districts. These advertisements brought out strongly the points of safety, rate of return and marketability of the stock and the fact that the company was a hydro-electric power company serving one of the fastest-growing sections of the United States. Circulars and subscription forms were mailed to every consumer on the system, and in addition a small sticker was attached to the electric light and power bills mailed out each month calling attention to the security. Permission was obtained from the managers of large and small factories to address their employees at the noon hour, and this was followed up by personal interviews with the men while they were at work at the factory or by calling on them at their homes in the evening. Simultaneously with the newspaper advertising illustrated articles appeared in the papers dealing with the enormous construction work which was being carried out at Big Creek and other parts of the system. Notices were sent to old stockholders asking them to explain to their friends and relatives what the Edison company was doing toward building up their community and telling them of the value of Edison stock as an investment.

Another great help was the action of the Edison employees' clubs in the various districts in putting on an entertainment and a dance and asking the general public to attend. On these occasions motion pictures were shown of the construction work in progress on the company's property.

No one was asked to purchase stock at these meetings, but the fact remains that when the employees subsequently called on customers they received a much better reception than if the person had not known of the constructive work of the company in the districts it serves.

A bonus of 50 cents a share was paid to all employees and a flat amount of $1 for every new stockholder they obtained, but no bonus was paid for sales made to stockholders already on the books. Additional prizes were offered to districts and departments for the ones who first made their quota of new shareholders.

It was found that the best salesmen were usually those who after having made a sale won the confidence of the purchaser and were able to get a list of the new stockholder's friends and relatives to work on. Some of our salesmen have been able to make as many as fifty additional sales through the good services of one stockholder.


Number of shares of stock sold to Public from August 1st 1917, to August 1st 1922 284,428
Number of shares of stock sold to officials and employees from August 1st 1917 to Sept 1st 1922 69,936
Total number of stockholders as of August 1922 48,259
Shares
Cancellations
John B. Miller Week
Aug Oct Dec Jan April July Oct Jan April July Oct Jan April July Oct Jan April July Oct Jan April July
1917 1918 1919 1920 1921 1922

STOCK SOLD TO CUSTOMERS AND EMPLOYEES IN FIVE YEARS

In every sales program unforeseen obstacles will crop out and they must be handled as they develop. However, our experience in customer ownership has shown some characteristic pitfalls which can be avoided, and a few words of caution may prove of value to other companies interested in selling stock locally.

PITFALLS TO AVOID

Do not expect the employees, in addition to their regular work, to go out and sell stock without an incentive. Give them a fair commission and extra prizes. In case of dispute as to the payment of a bonus on any particular sale by an employee, always give the employee the benefit of the doubt where possible, as nothing will take the "pep" out of an employee salesman more than to think he has lost a sale. Do not let employees try to sell to a selected list of people over the telephone. This is being done by every wildcat oil

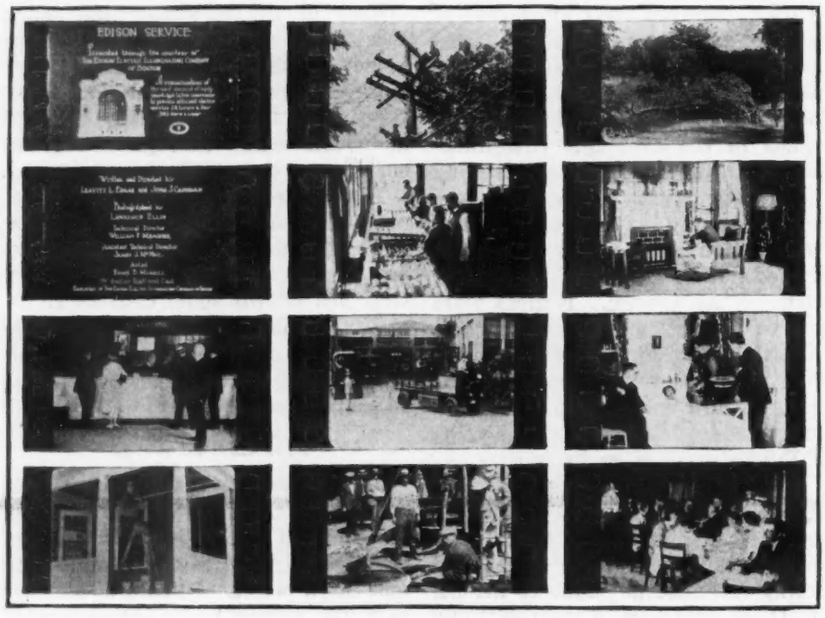
and mining company. A most important point in selling to the public is to remember that the woman of the house usually has something to say about making investments, and the most successful salesmen are those who first sell the idea to her. It is then an easy matter to obtain the consent of the husband.

Never make special prices to any one. If you are selling stock at $100 a share, be sure that every one pays the same price and that no rebates are given. With a large employee sales force it is only natural that statements are sometimes made that are not in accordance with the facts. When a stockholder says that certain statements were made to him investigate the matter thoroughly and always give the stockholder the benefit of the doubt, for, if he is treated with absolute fairness, he will be a booster for your company and its stock among all his friends and relatives.

Be sure to have your securities organization in such shape that the public will receive its certificates within a reasonable time after subscribing, and in any event see that a receipt is given for the money taken as soon as it is received by the company. In acknowledging receipt of money a letter should be sent to the subscriber explaining that a certificate will reach him within two or three weeks. Explain the routine that such a certificate must go through and the reason it takes so long to get it to him.

The measure of success in placing your securities with the general public depends on two things—first, the company's past treatment of its customers and the general public; second, the company's past record with its employees. If the company has been fair and aboveboard with reasonable rates, it will have the support of its consumers. If because of fair treatment the company has the whole-hearted support of its employees, it can ask them to do anything reasonable and they will go out and "put it over" with gusto. In other words, the success of building up a large customer ownership resolves itself into the old rule of co-operation.

"Edison Service" Film Features Varied Activities of Boston's System



TO ACQUAINT the public in its 640 square miles of territory with the extraordinary diversified task of supplying electric service under conditions ranging from the subsurface of a metropolitan street to the remote pole lines of distant suburbs, and to emphasize the varied uses of electricity in home office and factory, the Edison Electric Illuminating Company of Boston prepared an elaborate "movie" of its activities which will be shown to the public during the coming winter as a part of the lecture service maintained by this company. A few views from the film are reproduced here. The "actors" in the story were all company employees, and the entire film was prepared by company talent, with perhaps a single exception. As a means of better visualizing what "Edison service" means behind the scenes as well as beyond the meter the picture has already attracted much interest.

What Other Companies Are Doing

Stamford, Conn.—All previous records for electrical output on its system were broken by the Stamford (Conn.) Gas & Electric Company for the June-September period this year. The maximum daily output in kilowatt-hours recently ran 15 per cent above the largest single day's output during the war, including both day and night demands. Plans are being pushed for practically doubling the capacity of the company's generating plant in order to meet the additional load requirements. A general expansion of load along different lines rather than a spectacular growth in any one field of service is the characteristic of the situation.

Dallas, Tex.—The Dallas Power & Light Company reports 677 new customers added during September, which broke all past records for increase in residential business, according to C. E. McBride, assistant secretary and treasurer of the company. The majority of the new customers represented new homes. During the last nine months 3,025 new customers have been connected, bringing the total number of customers on the company's books up to 37,902.

Ohio.—Industrial power consumers, as reported by central stations of Ohio, now number 27,350, according to figures obtained from the Ohio Committee on Public Utility Information. The surveys show this to be an increase of 2,300, or 9.2 per cent over 1921, when there were 25,050 industrial concerns in Ohio using power furnished by central-station companies. In 1916 the total number of power users was 16,560. Since then power users have increased 153 per cent. In addition to the industrial users, there are more than 700,000 wired homes in Ohio.

Chicago, Ill.—An increase of 16.83 per cent in the electrical energy output of the various public utility properties of the Standard Gas & Electric Company for the week ended Oct. 20, 1922, was obtained over the corresponding week of 1921. Applications were received for 2,579 new electric services, which cover 1,293 kw. for lighting and 1,575 hp. in motors. The electrical connected load shows a net gain of 1,011 customers with 1,002 kw. of lighting load and 980 hp. of motors.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Utilization of Surplus Flood Water to Suppress Backwater in Water-Power Developments.—FLOYD A. NAGLER.—The effect of stream flow upon load capacity of an ordinary low-head hydro-electric plant indicates that the available output should increase with the volume of flow up to the maximum rating of the equipment and remain there uninfluenced by any further increase in the volume of flow because the surplus water goes to waste. Unfortunately, it would be an exceptional low-head plant that could maintain its maximum output as the stream flow approaches that of a flood. To sustain plant capacity under such conditions is a problem which may find its practical solution in the backwater suppressor scheme described in the article.—*General Electric Review*, October, 1922.

Proposed 450,000-Hp. Development at Niagara Falls.—Another plant has been proposed to develop this amount of water power by taking the water through a canal from about 4 miles above the Falls and discharging it into the lower gorge near Lewiston under an effective head of 301 ft. The plan includes a four-circuit, 220,000-volt transmission line to New York City, a distance of 315 miles. Nine turbine units of the vertical-shaft type would be connected to 45,000-kva., 12,000-volt generators, with transformers directly connected to the generators without any intervening switches. The cost of this generating station with the canal would be approximately $35,000,000. For the four-circuit transmission line with step-up transformer station at the generating end and step-down transformer station at the terminal, including everything complete, the cost would be about $27,500,000. Taking the amount to be earned on the investment as 15 per cent and the total earnings per year as $9,000,000, power at the terminal station in New York would be $35.30 per kilowatt-year, or 0.47 cent per kilowatt-hour, based on allowing this system to carry the base load for the metropolitan district and allowing the peak load to be carried on the steam plants.—*Power*, Oct. 24, 1922.

Generation, Control and Switching

Application of Relays.—L. A. TERVEN.—The fourth of a series of articles dealing with substation relay equipment for guarding against line faults.—*Electric Journal*, September, 1922.

The Overloaded Generator.— H. M. PHILLIPS.—The major considerations to avoid troubles due to overheated generators are considered. The main points discussed are the greater overload capacity when the machine is first started, how and where to place thermometers to obtain the best temperature readings, and the consideration that during cool weather greater overload capacity may be secured.—*Power*, Oct. 24, 1922.

Latest Transformer Standardization.—The latest edition of the "Transformer Standards Handbook" just issued by the Transformer Section of the Electric Power Club contains information on all transformer standardization effected by that organization to date. Copies may be obtained from any American manufacturer of distribution or power transformers. The information includes standard types, frequencies, sizes, voltage ratings, taps, lead markings, polarity, nameplate marking, accessories, basis of guarantees for distribution and power transformers and general engineering recommendations. Distribution transformers for lighting and power service and power transformers for lighting and power, constant-potential transformers and connections of single-phase transformers in multiple and in three-phase banks are covered.—*Transformer Standards of the Electric Power Club, Second edition*, September, 1922.

Transmission, Substations and Distribution

Capacity of Cables for Intermittent Loads.—LOCHHEAD.—The choice of the proper cable size for intermittent service should not be determined from the mean effective current, but from the time constant. This constant must be determined by calculation, and from a curve diagram the higher load for intermittent service as against constant load may be found. The drop of voltage limits the permissible length of the cable. Another set of curves gives a convenient and quick determination of this voltage drop for different sizes of cables and loads. The V. D. E. issued recently new rules for the intermittent current-carrying capacities of cables, and it recommends that the size of fuses for intermittently operating motors be selected not according to the cable size, but according to the highest permissible motor load.—*Brown-Boveri Mitteilungen*, October, 1922.

Water-Flow Indicator for Transformers.—A. M. ROSSMAN.—The water-flow indicator described consists of a heavy cone-shaped metal plunger floating in a circular orifice. The change in the amount of water flow demands a corresponding change in the free area of the orifice, and this is obtained by a vertical movement of the plunger in the orifice. This movement is transmitted through a bell crank and shaft to an external pointer which moves over a scale calibrated in gallons of flow per minute. A number of these indicators have been in successful operation since 1920.—*Journal of the A. I. E. E.*, October, 1922.

Units, Measurements and Instruments

A Simple Harmonic Analyzer.—V. BUSH.—This article describes a mechanical integrator. Its principal use is for the determining of harmonics of an irregular function such as the problem of splitting an oscillograph curve of current or voltage into its components.—*Publication No. 28 of the Massachusetts Institute of Technology.*

Stroboscopic Method of Speed Measurement.—V. A. FYNN.—The apparatus consists of a stroboscopic primary standard used for calibrating purposes, a stroboscopic slip meter for asynchronous motors permitting instantaneous readings, a stroboscopic device for instantly ascertaining the speed of any kind of a motor, and a number of tachometers of the magneto type. The calibrating device is based on accuracy of a tuning fork, as the rate of vibration of such a fork is of extraordinary accuracy well beyond the requirements of any ordinary laboratory. The stroboscopic slip meter comprises a synchronous self-starting motor controlled by a switch and mounted on a base provided with handles. The instantaneous stroboscopic speed-measuring device permits the rate of revolution of any motor to be determined on the instant without putting any load on the machine whatsoever.—*Journal of the A. I. E. E.*, October, 1922.

Tentative Standards for the American Society for Testing Materials.—The 1922 edition of the "Tentative Standards," just issued, comprises 774 pages and contains 163 tentative standards. Of these eighteen relate to steel, wrought and cast iron, thirteen to non-ferrous metals, twenty-seven to cement, lime, gypsum and clayer products, fifteen to preservative coatings, thirteen to petroleum products and lubricants, thirty-five to road materials, four to coal and coke, nine to waterproofing, five to insulating materials, four to shipping containers, twelve to rubber products, four to textile materials and four are miscellaneous.—*American Society for Testing Materials.*

Illumination

The Use of Light in Hospitals.—The Illuminating Engineering Society (London) arranged a joint discussion with the Royal Society of Medicine to discuss the chief problems in the use of light for hospitals, particular attention being devoted to lighting of wards and operating tables. The introductory paper by Mr. Darch was supplemented by a series of questions with the object of inviting additional information. The introductory paper tells the requirements for lighting operating tables. These requirements are very exacting. The dis-

cussion brought out valuable information on lighting of hospitals in general, wards, operating tables, special inspection lamps, microscope illumination, illumination of colored objects, the lighting of pathological museums and the lighting of dispensaries.—*Illuminating Engineer (London)*, Vol. XV, No. 6.

Electrical Response of the Retina to Stimulus by Light.—E. L. CHAFFEE and W. T. BOVIE.—It has been found that changes in electrical resistance or other characteristics are brought about in the eye and nerves when light impinges on the sensitive portion of the eye. These observations have been based on experiments with the eyes of frogs, the minute changes in current being amplified by vacuum tubes and indicated by sensitive galvanometers. Very interesting effects due to the action of light are described.—*I. E. S. paper, Swampscott, Mass.*, Sept. 25-28, 1922.

Motors and Control

Starting Direct-Current Motors.—C. A. ARMSTRONG.—An explanation is given of what happens when a motor comes up to speed and the starting resistance is cut out, and how the increasing counter-electromotive force in the armature may be used as a means of starting the motor automatically.—*Power*, Oct. 10, 1922.

Electric Drive in Tanneries.—J. A. LORNE.—A detailed description is given of the electric drive in two tanneries, one operating by the vegetable process and the other by the chrome process. The data presented amply demonstrate that the electric motor is readily adaptable to drive the variety of machines that are used in tanneries, is a desirable substitute for manual labor and a more productive, more reliable and yet cheaper motive power than has hitherto been used in this industry.—*General Electric Review*, October, 1922.

Winding Small Motors.—A. C. ROE.—The details of shop methods for winding small two-phase and three-phase stators are given. These include directions for checking the coil pitch, insulating the core and slots, taping the coil ends, etc. The types of winding covered are the basket winding, two-layer windings with one diamond-coil side per slot, the flat diamond mush coil, two-layer diamond mush pulled coils, and the winding with strap-copper conductors.—*Industrial Engineer*, October, 1922.

Heat Applications and Material Handling

Small Electric Furnace.—J. RITZ and G. KELLER.—A combination arc and resistance furnace is described in this long paper which possesses a number of desirable features, is simple and apparently inexpensive. It is a three-phase type with two graphite electrodes and the third phase connected to a bath electrode. The capacity of these furnaces is from 200 kg. to 300 kg. at an energy consumption between 80 kva. and 140 kva. The furnace itself has the shape of a horizontal cylinder, with two electrodes entering from the top, one behind the other, in a plane parallel to the main axis of the cylinder. The oven is stationary during the melting period and may be tilted by hand or hydraulically for pouring. The electrode regulation is governed by hand for each phase independently. An interesting feature is the possibility of lifting the melting drum out of the furnace frame, so that two or more drums may be kept by the foundry for two or more metals or alloys with only one frame or support. As a rule a three-phase furnace transformer with one reduced voltage tap in each phase is sufficient for the start and the running of the oven. To further minimize any possible voltage fluctuations on the line, a three-phase iron-core choke coil may be connected between the power line and the transformer primary. To improve the operating power factor this choke coil can be bridged by a short-circuiting switch. Complete tabulations of all operating data for melting twelve different metals and alloys are given, and also comparative operating costs between this furnace and oil-fired and coke-fired furnaces, showing very decided economies of the electric type.—*Brown-Boweri Mitteilungen*, October, 1922.

Electrophysics, Electrochemistry and Batteries

Applications of Electrical Equipment in the Metallurgy of Nickel.—J. L. MCK. YARDLEY.—Most of the metal at the present time is being recovered by pyrometallurgical methods, but the electric furnace is being used to some extent and its use is constantly increasing. This article gives a synopsis of the field for electric furnaces in the reduction of nickel ores and gives a description of some of the electrical apparatus at the new British America Nickel Corporation's refinery. It is apparent from the accompanying table that the nickel-electrolytic plant must be more than three times the size of the copper-electrolytic plant; also, that either electrical equipment of a different voltage range or a different number of tanks in series must be employed.—*Engineering and Mining Journal-Press*, Nov. 4, 1922.

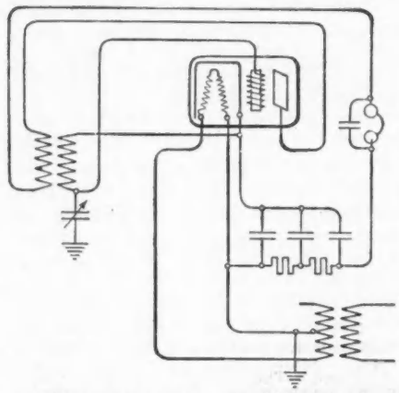
COMPARISON BETWEEN NICKEL-ELECTROLYTIC AND COPPER-ELECTROLYTIC PLANTS

	Copper	Nickel
Atomic weight	63.57	58.58
Chemical equivalent	31.785	29.34
Electrochemical equivalent, metal deposited per 1,000 amp.-hr., lb.	2.61	2.41
Heat of formation of sulphate, calories	197,500	228,700
Theoretical deposition, voltage	1.22	1.90
Theoretical metal deposited per kw.-hr., lb.	2.135	1.27
Practical ampere efficiency, per cent	80	80
Practical depositing voltage	2.0	3.0
Practical energy efficiency, per cent	50	50
Actual metal deposited per kw.-hr., lb.	1.07	0.635
Annual output assumed, lb.	9,500,000	18,000,000
Power required per annum, kw.-hr.	8,800,000	28,300,000
Electrolytic capacity required, kw.	1,020	3,280
Daily output of electric furnace, 310 days per year, tons	....	60
Daily tonnage of ore, approximate	1,500	.....

White Metals.—A. H. MUNDEY, C. C. BISSETT and J. CARTLAND.—The authors review the principal classes of white metal, their composition and physical properties, chiefly in relation to their uses and manufacture, and consider their constitution only as far as the user is directly interested. The metals considered include anti-friction alloys, bearing metals, printers' alloys, fusible alloys and die-casting alloys.—*Engineering*, Oct. 6, 1922.

Telegraphy, Telephony, Radio and Signals

Combined Kenotron Rectifier and Pliotron Receiver.—A. W. HULL.—A four-element tube is described which combines the functions of kenotron rectifier and pliotron and can be operated from an alternating-current source of power without either an "A" or a "B" battery. The cathode is an equipotential surface so that alternating-current hum is inappreciable even with three stages in series. The combination of equipotential cathode and large cathode area results in unusually high amplification and detection constants, making the tube a practical radio-frequency amplifier.—*Paper presented before the Institute of Radio Engineers, New York*, Nov. 1, 1922.



RECEIVING CIRCUIT FOR 110-VOLT TUBE USING POWER LINE AS ANTENNA

Miscellaneous

Torsional Strength of Reinforced-Concrete Beams.—C. R. YOUNG, W. L. SAGAR and C. A. HUGHES,—A series of torsional tests on rectangular reinforced-concrete beams have been made by the authors with the following results: Rectangular specimens of plain concrete develop substantially the same computed maximum torsional shearing stress at the center of the long sides. For 1:2:4 concrete this is about 540 lb. per square inch. Longitudinal reinforcement was found to be valueless. Spiral reinforcement increases the torsional strength of beams. Spiraling to the amount of from 0.4 per cent to 1 per cent increases the strength from 20 per cent to 25 per cent.—*Canadian Engineer*, Oct. 10, 1922.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N.Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Batteries, Storage, for Mine Locomotives.

Endurance tests indicate that the battery cells at present supplied for mine locomotives have sufficient mechanical endurance to withstand the ordinary jolts they are likely to receive in service. Details of these tests are given in Serial 2,358.—*U. S. Bureau of Mines, Pittsburgh, Pa.*

Brush, Carbon, with Laminated Texture.

A brush of high specific gravity has been developed having a laminated texture. The resistivity of the brush in the direction of its thickness is between five and six times that along its length. This tends to cut down the cross-bar or short-circuit currents; the permissible current density is thereby increased and the commutation improved.—*Pure Carbon Company, Wellsville, N. Y.*

Coal, Spontaneous Combustion of.

The relative tendency of the Pennsylvania coals to ignite spontaneously has been investigated. The research consisted largely in the development of methods for the determination of the comparative sensitivity of coals to oxygen. The coal constituents were separated by the aid of a microscope. —*U. S. Bureau of Mines, Pittsburgh, Pa.*

Instruments, Alternating Current, Thermocouple Type.

Recognizing the difficulties involved in measuring very low alternating potentials by means of the ordinary portable instruments, we have recently produced low-reading alternating-current voltmeters on the thermocouple principle, similar to the thermocouple ammeters used for radio-frequency work. The thermocouple is inclosed in a glass bulb partially filled with hydrogen gas, the object of which is to give the filament a quick thermal action. In other words, its temperature is quickly established. Bulbs which are electrically interchangeable are produced by varying the amount of hydrogen contained until with a given current a certain thermal emf. is produced. By means of these bulbs low-reading thermal ammeters and milliammeters are also produced.—*Paul MacGahan, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Magnetic Tests with Superimposed Alternating Current and Direct Current.

A study was made on iron-core toroids with alternating current to see to what extent the constant field changes the permeability to a rapidly alternating field and whether the previous history influences this permeability and the resulting energy losses in iron. Aside from its bearing upon theories of magnetism, this problem is of interest in the double-frequency transformer, the telephone receiver and in numerous other applications of the polarized electromagnet, where the direct-current field is superposed upon an alternating field. The performance of these devices is conditioned by the change in effective permeability to an alternating field when the core is under the magnetizing action of this constant longitudinal field.—*Alva W. Smith, Ohio State University, Columbus, Ohio.*

Ohm's Law, Deviation from, at High Current Densities

On the basis of the free electron theory, currents at very high densities would be expected to increase as the square root of the applied emf. Measurements were made on very thin strips and films of gold and silver, using a Wheatstone bridge. The specimen was traversed simultaneously by a heavy current and a small alternating current of acoustical frequency. Some traces of the theoretical effect were found.—*P. W. Bridgman, Harvard University, Cambridge, Mass.*

Plating, with Silver.

A large brass parabolic mirror was heavily silver-plated by the bureau recently. In doing so some valuable information regarding the practical operations of plating was obtained.—*Bureau of Standards, Washington, D. C.*

Relays, an Apparatus for Studying the Motion of.

It is of considerable importance to know how the contact points move relatively to each other. The electrical methods commonly employed for determining relay characteristics are quite inadequate; oscillographic records of current merely tell whether contact is single or multiple; methods depending on charging of condensers are only applicable to clean breaks and so are impracticable for the study of the very important case of "chattering." An apparatus was designed for the purpose of obtaining photographic silhouettes, or "shadowgrams," of the moving contact points. In the optical arrangement a "pointolite" lamp is used. An image of the contacts and the pointolite is formed by a lens upon a narrow slit, parallel to the direction of motion of the contacts, and lying closely in front of a rapidly moving photographic film. The shadow traced on the film will be a record of the relay's motion. For details see the *Journal of the Optical Society*, Vol. 6, 1922, page 391.—*H. E. Ives and T. L. Dowey, Western Electric Company, New York City.*

Thermophone, Theory of.

Formulas have been derived for the maximum value of the alternating pressure produced within the inclosure of any thermophone when a given alternating current, superposed on a direct current, is passed through the central foil or wire. These formulas have been verified experimentally by calibrating an electrostatic transmitter with four different thermophones and with a pistonphone. For details see *Physical Review*, Vol. 19, 1922, page 333.—*E. C. Wente, New York City.*

Research in Progress

Lubricating Oil, Reclaiming of.

Experiments with a commercial type of oil reclaimer, which involved increasing the temperature at which the oil was allowed to stand from 180 to 200 deg. F., increased the amount of oil recovered from 80 to 89 per cent. The reclaimed oil seems to be similar to new oil, except with regard to sediment. Satisfactory means for the removal of this sediment, which is probably carbon, requires further investigation.—*Bureau of Standards, Washington, D. C.*

Mines, Electric Shot-Firing Equipment for.

Two series of studies have been undertaken in connection with electrical shot-firing methods in mines—(1) the relative danger of firing shots with iron and copper "leg" electric detonators, which has a possible bearing on the mine fires reported in the Utah field; (2) the cause of "misfires" in the firing of a large number of series shots by push-down-type blasting machines in places where the leakage current through the earth is excessive.—*U. S. Bureau of Mines, Pittsburgh, Pa.*

Plating, with Platinum.

A few experiments upon platinum plating from the phosphate solution indicate that there is no great difficulty in securing bright deposits, but the deposits so far produced have been found to furnish very little protection against attack upon the underlying metal by such reagents as nitric acid. If platinum plating is to find extensive use on analytical weights or for the protection of chemical apparatus, a means must be found for producing dense impervious deposits of the metal. Further experiments are in progress.—*Bureau of Standards, Washington, D. C.*

Suggestions for Research

Cables, Intermittent Load on.

In order to compute the temperature rise of a cable with an intermittent load, it seems convenient to introduce the "time constant" of the cable. This constant is defined as the interval of time necessary for raising the temperature of the cable to its safe upper limit, with a continuous load current, when the heat is not conducted or radiated away, but is stored in the cable. For a beginning of such a theory of cable heating see *Brown-Boveri Mitteilungen*, Vol. 9, page 213, October, 1922.

Dielectric Strength, Influence of Thickness

It is well known that the puncturing voltage for solid insulation in plate form is a function of the thickness of the samples. The ultimate strength increases more slowly than the thickness; in other words, thin layers stand in proportion a higher voltage. Assuming the breakdown to take place along a patch of small imperfections in the material, it is desired to apply the mathematical theory of probabilities to the distribution of weak points and to deduce a relationship between the thickness of a plate and the ultimate voltage at which it breaks down.

Fuses for 2,300 Volts and Above.

At the recent convention of the Empire State Gas and Electric Association E P. Peck of Utica, N. Y., called attention to the lack of satisfactory fuses for voltages of 2,300 and above.

Maximum-Demand Meters.

At the recent annual convention of the Empire State Gas and Electric Association at Lake Placid a need for further study of maximum-demand meters was emphasized and the following problems were brought out: (a) What are the relative registrations of different types of demand meters with different time intervals on one and the same load, uniform or fluctuating? (b) How does a consumer's kva. demand (or poor power factor) affect each part of the electric system, back to the prime-mover shaft? (c) Advantages and disadvantages of different thermal-type load indicators. For an experimental study of maximum-demand meters see Borden, *A. I. E. E. Transactions*, Vol. 39, 1920, page 1847.

Measuring Instruments, Scale of.

In some instruments, such as hot-wire ammeters and electrodynamometer-type voltmeters, the lower part of the scale is suppressed, making the instrument comparatively inaccurate in the lower range. Among different suggestions for improvement, one that recently came from abroad consists in measuring not a constant fraction of the quantity concerned, but a fraction which itself varies according to a predetermined law.

Thermocouples for Measuring High-Frequency Currents.

It is of importance to develop thermocouples which can be worked up in wire form, suitable for temperatures not over 400 deg. C., and which would have a thermo emf. in excess of the value given by the materials now in use. The materials in most common use now are "advance" or constantan, with copper or with iron, and constantan with manganin. These materials give a thermo-emf. of approximately 40 to 50 microvolts per degree Centigrade. The results would be of importance in application to instruments of the thermocouple, D'Arsonval type, used for measuring high-frequency currents. The design of such instruments is now very much limited by the weak forces in the instrument produced by existing thermocouples. — *Paul MacGahan, East Pittsburgh, Pa.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Los Angeles Loses Fight

Court of Appeals Refuses to Let It Condemn Owens River Plant of Southern Sierras Company

THE city of Los Angeles has lost its fight to condemn for its own use a power site on the Owens River belonging to the Southern Sierras Power Company. A decision of the United States Circuit Court of Appeals, just handed down, reverses the victory won by the municipality in the District Court in July, 1921, dismissing the complaint and assessing costs against the city. The decision, which restores the property to the Southern Sierras Power Company, is of importance throughout California as well as the rest of the nation, as it holds that a municipal corporation has not the right to condemn property which a private corporation is devoting to the public uses of other municipalities.

The contention of the Southern Sierras Power Company and its predecessor in ownership, the Mono Power Company, that the needs of the six counties and numerous southern California cities and towns which it serves were equal to the rights of the city of Los Angeles was completely upheld by the Circuit Court. In the lower court a jury had fixed the condemnation price at $525,000, and Judge Van Fleet held that Los Angeles had a superior interest in the power site, which comprises 320 acres, extending a mile along the river at the steepest point in the Owens River gorge.

The Southern Sierras Power Company does not render any public service to the city of Los Angeles or its inhabitants and does not propose to do so, but it sells energy in bulk to Riverside and Redlands and serves directly San Bernardino, Corona and other places. There was no evidence in the case to the effect that the use of the property sought to be condemned for the purpose of providing electrical energy for the present and future needs of Los Angeles was in fact a more necessary use than the public use of the property by the defendant for the present and future needs of the counties, municipalities and towns it serves.

Italy Likely to Give Up State Ownership of Utilities

According to press dispatches, Premier Mussolini, the Fascisti leader who has become head of the Italian government, means to bring about the transfer of public utilities, including railroad, telephone and telegraph services, to private ownership. All these utilities have, according to the dispatch, been operated at a loss.

It is asserted that the government has already begun negotiations for the turning over of the government telephone system to a private company with headquarters at Milan. The condition of the government system has been serious for some time, and more than 100,000 applications for telephones have been refused because of lack of funds. For more than ten years the Ministers of Telegraphs have been asking for 1,500,000 lire for the improvement of the telegraph and telephone lines, but the government has been unable to supply any such sum.

The proposed remedy, it is said, meets with a large degree of public approval. A similar movement in France, so far at least as telephone service is concerned, was noted in the issue of the *Electrical World* for Oct. 28, page 952.

Commissioners Discuss Their Problems

Detroit Meeting Full of Interest—Rural Service, Public Ownership, Safety of Operation, Rates and Depreciation Rules Are Debated—Lewis of Iowa Elected President

THE augmented problems of utility and railroad regulation with which public service commissions now believe themselves confronted were responsible this week for the very large attendance at the thirty-fourth annual convention of the National Association of Railway and Utilities Commissioners at Detroit. Prominent among questions considered up to the time this issue of the *Electrical World* went to press were rural extensions of electric service, the report of the committee on public ownership and operation, and the question of regulated monopoly or regulated competition as it is involved in the telephone industry.

Detroit's Mayor Sees Municipal Ownership Growing

Mayor Couzens in his welcoming address told the commissioners that municipal ownership is on trial and that it will continue to grow. He thought the commissioners had not yet entirely eliminated graft, interlocking relationships, unreasonable salaries and other excessive expenses from public utilities. He did not object to a fair return on capital invested, but to the tricks of the bankers and lawyers in boosting the costs upon which people are asked to pay a return.

President Jackson's Sound Address

President C. D. Jackson in opening his address cited the tendency of the federal government to take charge of almost all forms of human activity, to usurp all the ordinary police power of the states and to substitute centralized paternalism for red-blooded initiative and local solution. In his estimation no organization more completely represents the sentiments of the several states and the local needs and problems of the country than the National Association of Railway and Utilities Commissioners, and none can be more effective in combating federal paternalism.

As touching the movement toward centralization, Chairman Jackson cited the tendency of the telephone companies to shift from the jurisdiction of the state commissions to that of the Interstate Commerce Commission. He did not go into the various ramifications other than to touch on the possibilities of telephony in interstate commerce and the divergence of opinion which exists between the Interstate Commerce Commission and the state commissions on the proper treatment of depreciation and retirement reserves. He deprecated this tendency on the part of the telephone and telegraph companies and stated that any temporary advantage to these utilities from the undue extension of federal interference with local control and regulation would in the end be far more than offset by disadvantages of a very concrete and perhaps disastrous nature. Good public relations, he maintained, are not helped by centralized and distant administrative regulation.

He referred to the present form of socialistic or communistic agitation for state and federal ownership of vast utility properties and was glad to know that California had emphatically repudiated this socialistic propaganda and that virtually the same verdict had been given in Wisconsin.

Dwelling on the monopolistic nature of the public utility business and on the question of franchises, Mr. Jackson cited the chaotic condition which exists in the laws of the several states by reason of which just, stable and effective pub-

lic service regulation is hampered. Local public relations are susceptible of considerable improvement in the estimation of the commissioner through such channels as customer ownership of securities. The other advantages which accrue to the utility owing to local ownership were also emphasized. Chairman Jackson drew attention to the necessity for opening all legitimate fields for securing capital to public service corporations and the part which public service commissions should play in fostering the credit of utilities under their jurisdiction. No-par-value stock and the evils of tax exemption also came in for comment. Summing up, Chairman Jackson voiced the duty of commissioners to bring the great public service of the country to all the people on the most reasonable and fair basis to all concerned.

The address of C. C. McChord, chairman of the Interstate Commerce Commission, on the relation of state to federal regulation was a feature of the afternoon session on Tuesday.

Public Ownership and Operation

The report of the public ownership and operation committee was presented by A. G. Patterson of Alabama. Last year's committee was unanimously opposed to such methods and in favor of the private ownership and operation of public utilities. This year's committee, which was quite optimistic on the future of electric utilities, also announced its belief that the public utility business is essentially a private business. It complained, however, about the prevalence of litigation to prevent public utility commissioners from justly reducing prevailing high rates. The committee expressed itself as strongly of the opinion that the proper solution of the railroad situation would have a tremendous effect in retarding sentiment favoring government ownership and operation of railroads and other public utilities, and to that end it recommended that the Railway Labor Board be abolished and its functions transferred to the Interstate Commerce Commission.

Safety of Operation

The committee on safety of operation of public utility companies suggested that the National Electrical Safety Code be accepted as the best guide for use in the formulation of electrical safety rules. It appeared from the report that twenty-nine of the railway and utility commissions have adopted safety rules relating to the construction and operation of electrical supply and signal lines, and of these about eight follow the National Electrical Safety Code.

The committee recommended that special effort be made to impress upon the management of utilities, first, the economic value of safety work; second, that conditions which were prominent a few years ago have quite disappeared; third, that sound, reasonable plans should be followed consistently and if possible should be carried so far as to outline a tentative program which would become a permanent part of utility operation.

Rates for Hydro-Electric Service

The greater part of the report on public utility rates was devoted to the electrical business, particularly to the hydro-electric development and transmission of energy. The committee contended that the development of the water powers of the country under proper safeguard is in the public interest, but that this development is only practicable where it is possible to obtain a market by transmitting the energy over considerable distances.

Referring to the recent Wisconsin Supreme Court case, in which the court held that communities adjacent to the source of power are entitled to more favorable rates, the committee, notwithstanding this decision, held that the proximity of a city or village to water-power development should not give a priority of interest in that development. In its estimation there are considerations of public policy which not only justify the grouping of communities into a single unit for rate-making purposes but make such grouping of foremost importance.

The committee did not take the position that rates in all cities and villages served should be the same. It believed that the development of water powers is intended to be for the general good of the people who can reasonably be served from those powers, and that the market for the energy should be such that no one community will have great competitive advantage over others in attracting industries because of its proximity to the power. The interest of the state or of the entire geographical section which can be served from a hydro-electric plant ought to be paramount to the interests of any particular community in that section.

National Character of Telephone

Almost one whole session was devoted to the telephone question. H. B. Thayer, president American Telephone & Telegraph Company, explained the methods and objects of the Bell Telephone System, dwelling on the three classes of service it furnishes—community, state and interstate—which subject the system to three kinds of control, municipal, state and national. With the exception of interstate toll rates, regulation is, however, generally by state commissions, and thus these commissions are confronted with the problem of considering the value to their constituents of telephone development outside the state and the cost of service part of which is rendered beyond the jurisdiction of the state commission.

"Aside from all questions of economy and efficiency," said Mr. Thayer, "a national universal service could not be provided at all by a large number of unco-ordinated local units. As a part of its plan, the contract between the American Telephone & Telegraph Company and the associated companies provides in general terms for such services to the associated companies as can be most economically and efficiently rendered by one central agency. A division between national and sectional toll lines cannot follow state lines. The long lines form one part of the national machine, designed to handle such long-distance service as may be most efficiently and economically provided through this means and so designed to make the national machine as a whole operate most efficiently and economically."

Frank B. McKinnon, president United States Independent Telephone Association, spoke for that body, pointing out the advantages to the public of maintaining competition, though not by any means duplication of service in the same area. Mr. McKinnon argued that all true measure of the value of telephone service and much incentive to progress would be lost if the independent group were to be eliminated entirely, with its operating companies, its factories and its personnel. The success of the independent companies, said Mr. McKinnon, lies in their local character and personality, that is, the personal nature of their service. He raised the question whether the time is not now here when rates should be based on service rendered, and not alone on valuation, thus allowing some regard to be given to economical and efficient management.

Chairman Clyde M. Reed of the Kansas Public Utilities Commission strongly supported the maintenance of an independent telephone group as tending to bring about a healthy condition for telephone service generally.

Discussion of Depreciation

An extended discussion of depreciation resulted from raising the question of telephone depreciation as apparently delegated to the Interstate Commerce Commission for determination by the transportation act. In so far as the discussion affected other utilities, it was brought out that most commissions favor a depreciation reserve, such reserve to be so set up as to provide for a sum equal to the cost, less scrap value, of a given piece of property at the time of its retirement, provided, however, that excessive depreciation reserves be not allowed to accumulate owing to error in figuring the life of property.

Rural-Line Extension

The round-table discussion of rural-line extension showed the nation-wide interest in and the importance of this subject. In introducing it Henry G. Wells of Massachusetts presented the report of the committee on service of public utility companies and showed how the attitude of the public service company had changed from the negative one of two or three decades ago to one of desire and serious effort to make the first aim of such companies service to the public. The solution of the perplexing problem of how to extend that service to rural communities on a basis equitable to both consumer and utility has been often attempted, but these attempts are frequently mere

compromises and a real basis is needed.

Sherman T. Handy of Michigan spoke of the Michigan committee of seventeen now seeking a solution and pointed out that extensions of electrical service to rural communities will do more than anything else to keep people on the farm. A particularly urgent demand comes from the farmhouse; for, while farming methods in the field have been improved since 1900, farmhouse life remains much the same. It is true that the average farm consumption per customer is low now, but at present it is pioneer work. Mr. Handy believed that the farmer once on the line will ultimately become a large consumer.

Mr. Flagg of the Washington State Department of Public Works read from the proposed rules of the department which attempt to get away from approaching the problem as one of extension financing and to approach it as one of extension revenue alone. The idea is without setting up special rates to make an extra service charge so that ratio of return to investment on rural lines may be about the same as the ratio of return to investment on the rest of the system.

THE NEW OFFICERS

The following were elected for the ensuing year: President, Dwight N. Lewis of Iowa; first vice-president, Alexander Forward of Virginia; second vice-president, H. G. Taylor of Nebraska; secretary, J. B. Walker, secretary New York Transit Commission, and assistant secretary, J. H. Corbitt, secretary Tennessee Railroad and Public Utilities Commission.

The next convention will probably be held at Miami, Fla., in December, 1923.

President of Alabama Commission Favors Ford Offer

A. G. Patterson, president of the Alabama Public Service Commission, was quoted at length in the Detroit papers of Wednesday this week as saying that Alabama and the other Southern States interested favored giving Muscle Shoals to Henry Ford and that under no circumstances would they consent to its going to the Alabama Power Company, controlled, as in their opinion it is, from Wall Street. In an extended discussion on this matter with a representative of this paper Mr. Patterson said that primarily Alabama was interested in the proper development of the region and that so far, according to the Congressional supporters of Ford, he had made the most attractive proposition. Therefore Alabama favored Ford having Muscle Shoals, provided that he and Congress could eventually agree, as Mr. Patterson thought they could.

The South does not believe Ford to be a philanthropist, Mr. Patterson continued, but thinks that he is looking, quite naturally, for profit from the venture. Nor does the South believe Ford's offer should be accepted as last drawn; but if Ford so modifies his offer that Congress can accept it, Mr. Patterson believes that, on account of the magnitude of the proposition and the benefits to be derived from it, the period of lease should be extended from fifty to a hundred years, an exception to the usual practice being justified. The same exception might well apply to other projects as well, Mr. Patterson admitted, if necessary to promote needed development. Moreover, if any one else should make a more attractive offer than Ford for Muscle Shoals, he should have it. Whoever gets it will be subject to regulation as to rates, whether for industries owned by Ford or for industries owned by others. But, to summarize Mr. Patterson's view, so far as opportunities now exist to develop the Shoals, Ford has made the best offer and he and Congress will, Mr. Patterson thinks, finally be able to get together on businesslike terms.

Samuel Insull on Financing

Tells How $60,000,000 Has Been Raised by Commonwealth Edison With No Recourse to Bankers

MORE than 600,000 shares have been placed with customers of the Commonwealth Edison Company since this plan of financing was adopted by it early in the war period, and $60,000,000 has been raised without recourse to the ordinary means of raising capital through banking houses. This was the statement made by the company's president, Samuel Insull, in an address which he delivered in New York before the Bond Club last week on the subject of local public utility financing.

Mr. Insull's companies were among the pioneers in that field of financing, and he set forth many reasons why he has found the plan exceedingly desirable. In the first place, Mr. Insull said, it serves to promote that thing which is most desirable in the operation of electric light and other utility properties—the interest of the customers in the success of the venture—or, as he put it, "it gets everybody yelling for us." He mentioned several instances in which public utility companies have been materially aided through the efforts of their customer stockholders.

His company was led into the customer-ownership proposition by the necessities of war, he said. When war began in 1914 it was found that large amounts of the stock of the company held abroad were being sent here for liquidation and it was then that the system of distributing that stock among customers was first tried out. Its success is measured by the figures which he presented, showing that, although in the first two or three years only about $1,000,000 a year was raised in this fashion, in 1920 customers purchased 14,358 shares at a cost of $14,684,210 and in 1921 they bought 149,890 shares, paying the company $14,840,932. This year, up to Nov. 4, total sales under this plan have amounted to 287,186 shares, with a value of $28,119,203. Mr. Insull said that most of the utilities had pulled through post-war difficulties in excellent fashion.

Hydro Takes Over Toronto Power Company

On Nov. 1 the Hydro-Electric Power Commission of Ontario took over all the property of the Toronto Power Company for a consideration of $32,734,000. Negotiations have been under way for a considerable time, but the so-called "clean-up deal" was not consummated until last week.

The properties involved embrace the Electrical Development Company of Ontario, with power house at Niagara Falls, Ont.; the Toronto Power Company, the Toronto & Niagara Power Company, the Toronto Electric Light Company, the Toronto & York Radial Company and the Aurora & Schomberg Railway Company.

The Toronto Power Company will continue as a separate corporation with the following officers: Sir Adam Beck, president; Col. D. Carmichael, vice-president; W. W. Pope, secretary; F. A. Gaby, director, and J. W. Gilmour, treasurer.

Memphis Electric Sold

The Memphis Gas & Electric Company was sold at receiver's sale on Wednesday for $10,000,000. F. B. Odlam of New York, representing creditors holding claims amounting to $12,500,000, was the only bidder. The property was sold first in five parcels, on which bids aggregated $9,990,000, and then offered as a whole. The sale must be confirmed by the Federal District Court. The corporation will operate the gas and electric plants under the name of the Memphis Power & Light Company, and the new company, of which H. C. Abell of New York will be the head, will be functioning by Jan. 1, 1923, according to its attorney.

The new owners are pledged to expend $2,000,000 in improvements within eighteen months from the day they begin operations.

Hope for Early Development on the St. Lawrence

There are hints in official circles of an important development in the St. Lawrence River situation. It is believed that private interests are preparing to make a start on one part of the project. Studies now are being made of the power market in and around New York and Boston with the idea of estimating the extent of that market at the time when the proposed development shall have been completed. The construction of dams at Long Sault and at Cat Island is being considered, as is also a plan of constructing only one dam at Long Sault. Such a plan, which would make available 1,200,000 hp. of primary power, has the advantage, it is claimed, that no treaty or understanding with Canada would be necessary. It would only be necessary to utilize the existing machinery of the Federal Power Commission and the International Joint Commission.

Arkansas Executives Meet

Utilities Association, Meeting at Hot Springs, Talks of Service, Rates and Engineering

MEETING at Hot Springs, Ark., last week for its fifteenth annual convention, the Arkansas Utilities Association listened to a plea for fair treatment of the utility companies made by E. F. Wickwire, secretary Ohio Brass Company, Mansfield, Ohio, who declared that manufacturers and workingmen alike are becoming aware to what a large degree their own prosperity is contingent on that of the utilities. "If the income of utilities is limited by legislative enactment while the outgo runs riot," said Mr. Wickwire, "public service development must cease and even begin to go back. The real point for the individual to consider is whether it is to his interest to pay a rate which will enable the utilities to render good service or whether he would be better off if he had to furnish his own electricity, gas and transportation."

Percy Redmund of St. Louis, general manager of the Southwestern Bell Telephone Company, talked on "Service," and urged the liberal use of publicity upon utility men. An address by W. N. Gladson, dean of the College of Engineering of the University of Arkansas, led to the appointment of a committee to co-operate with the dean in trying to enhance the value of the engineering experimental station at the university.

Other addresses were made by former Gov. Charles H. Brough, who said that Arkansas ranked twelfth among the states in the efficiency of her utilities; by Robert Neill, a Hot Springs banker, who dwelt on the relation of the bankers to the utilities, and by H. A. Lane of the Joint Committee for Electrical Development. At the dinner-dance short talks were given by H. C. Couch of Pine Bluff, Earle Hodges, director of the Arkansas Public Service Information Bureau, and Messrs. Wickwire, Redmund and H. A. Lane.

These officers were elected for the coming year: President, S. A. Lane, Little Rock; first vice-president, J. L. Longino, Pine Bluff; second vice-president, Arthur E. Main, Mammoth Springs; secretary-treasurer (re-elected), R. I. Brown, Little Rock. The 1923 convention will be held at Pine Bluff.

Election Results of Interest to Public Utilities

The "convenience and necessity act," No. 12 on the ballot in the State of Washington, failed at the elections on Nov. 7 by a vote of a little less than two to one. The 1921 Legislature passed the act and the Governor approved it with the veto of certain of its minor provisions. A few days before the act would have become a law the referendum was invoked and the proposed measure was put to a vote of the people. The act required a public utility before entering a field already served by another utility to obtain first from the state authorities a certificate of convenience and necessity.

South Dakota electors voted down the proposal to build a state-owned hydro-electric power plant.

The defeat of the water and power act in California by a great majority, as reported in the *Electrical World* last week, has had a stimulating effect in investment circles in the Far West, and several utility issues which were withheld pending the election will, it is reported, soon be placed on the market.

Dispute on Musquash Power Leads to Mayor's Defeat

A dispute over the disposition of electrical energy from the Musquash hydro-electric development in the Province of New Brunswick, Canada, has, press dispatches say, led to the recall of the Mayor of St. John, whose opponent polled 4,304 votes to the Mayor's 3,289. It was alleged that the Mayor had, in the negotiations for power between the city and the provincial government, unduly favored the New Brunswick Power Company, which controls the electric light and power, street railway and gas systems of St. John. United States investors own large blocks of the company's securities. The fight, it is said, is likely to reach the courts.

I. E. S. Demonstrates Proper Home Lighting

At the November meeting of the New York Section of the Illuminating Engineering Society on Nov. 9 W. H. Rademacher of the Edison Lamp Works of the General Electric Company presented a comprehensive lecture on "Common-Sense Electric Lighting in the Home." The lecture was simplified by the use of a revolving stage which clearly demonstrated the contrast of good and poor lighting. With the aid of this exhibit Mr. Rademacher pointed out the many common errors which are found in existing installations and demonstrated how, at a comparatively moderate cost for the proper type of luminaires, the lighting of the living room, dining room, bedroom and kitchen can be improved.

Water Power in Arkansas

Progress of Little Red River Hydro-Electric Project—Annual Output of 175,000,000 Kw.-hr. Predicted

THE first unit of Arkansas' first large hydro-electric project will be completed on Little Red River, near Judsonia, by the Arkansas Power Corporation in March, 1923, if construction work moves along at its present rate. In a recent interview Virgil Pettie of Little Rock, president of the corporation, said: "The entire project is financed, a market for two-thirds of the power already arranged for, and we anticipate no interruption in our work. There is little doubt that the sections reached by our transmission lines will undergo a tremendous industrial growth. The territory produces 100,000 bales of cotton annually and has immense undeveloped resources in timber, stone and minerals. Railroad facilities are excellent.

"The drainage area tributary to the two dams the company will build is 1,400 square miles, with an average rainfall of 48 in. The average run-off is 2,200 cu.ft. per second. The annual power output from both units is figured at 175,000,000 kw.-hr. Dam No. 1 will be 85 ft. high and 800 ft. long. Dam No. 2 will be 150 ft. high and 1,050 ft. long. The first dam will create a lake in the Little Red River 18 miles long. Dam No. 2 will create a lake 42 miles long. These lakes will contain approximately 11,300 acres and 24,000 acres respectively. Besides the industrial value of the power, these two lakes in the very heart of the beautiful Ozark Mountains, will create one of the largest and most popular vacation grounds in the South.

"There will be a total of 256 miles of transmission lines. Ninety miles of this will be strung on steel towers, 166 miles on heavy wooden poles. A tremendous saving of coal will be effected by the construction of this plant. Figuring 3 lb. of coal per kilowatt-hour, the estimated saving on an annual output of 175,000,000 kw.-hr. will be 262,500 tons. At five dollars a ton this amounts to $3,600 a day."

The largest single market for power the corporation has is North Little Rock, where it has already a franchise.

COFFERDAM NO. 1 IN LITTLE RED RIVER, ARKANSAS

The Brazilian Congress

International Engineering Meetings at Rio de Janeiro Cover Wide Radius of Interest

AT THE international engineering congress held at Rio de Janeiro, Brazil, from Sept. 17 to Sept. 30, in connection with the Brazilian Centennial Exposition, North America was represented by delegates from the four big engineering societies as well as from six or eight other bodies of the United States and Canada. A. W. K. Billings, F. J. W. Luck, C. M. Mauseau, J. H. Payne, C. W. Rice, F. H. Shepard, Edwin A. Sturgis and William V. B. Van Dyck were the delegates from the American Institute of Electrical Engineers. Mr. Rice, who also headed the delegation of the American Society of Mechanical Engineers, was made the personal representative of the engineers in this country to continue from Rio de Janeiro with messages to the engineering societies in other cities of South America.

The work of the congress was divided into these eight sections, which show definitely just what problems were considered:

1. Overland, maritime, fluvial and aërial transportation; the Pan-American railway, practical means for its construction.
2. Iron metallurgy.
3. Fuels.
4. Hydraulic power; its utilization as motive power.
5. Sanitation, dams and irrigation.
6. Maritime and fluvial ports, their régime and relations with international navigation.
7. Machinery for agricultural and industrial purposes.
8. Standardization of statistical methods in ports and railroads.

Papers from United States

Twenty-three papers were presented by the four national engineering societies of the United States. Those of especial electrical interest were: "Utilization of Low-Grade Fuels with Seymour Pulverizers," Erie City Iron Works, Erie, Pa.; "Electrical Apparatus for High-Tension Power Transmission," Stephen Q. Hayes; "Technique of Radio Broadcasting," S. M. Kintner; "High-Head Hydro-Electric Development in the Mountains of California," A. A. Northrop; "Long-Distance Telephony in the United States," Bancroft Gherardi and H. S. Osborne; "Development of Electric Drives for Cotton Mills," C. N. Johnson; "Some Service Records of Electric Locomotives and Motor Cars in American Heavy-Traction Service," Homer K. Smith; "Static Transformers for Pressures of 150,000 Volts or Higher," Walter S. Moody; "A New Electric Furnace for Brass, Bronze and Copper," J. Murray Weed; "Factors Limiting the Voltage of Long-Distance Transmission Lines," F. W. Peek, Jr.; "Development in Hydro-Electric Practice," T. A. E. Belt; "Large High-Voltage Oil Circuit Breakers," E. M. Hewlett; "High-Voltage, Long-Distance Transmission of Power," B. Nikiforoff, and "Present Status of the Electric Furnace for the Iron and Steel Industry," John A. Seede.

Personnel Association Discusses Engineering

Co-operation with the engineering colleges was urged by a committee of the National Personnel Association at the first annual convention of the association, held in Pittsburgh last week. "The present state of engineering education is one of active flux," said the report of the committee, of which W. E. Wickenden, American Telephone & Telegraph Company, was chairman. "Educators and officers of industry are agreed that the demands of civilization on the engineer are becoming broader and call for a more fundamental and less specialized form of education. Engineers have achieved brilliant success in creating the machines and structures which make modern industry possible. They are now being called upon to give equal concern to the agencies of society which utilize this material equipment."

"Human Factor" in Engineering

The committee dwelt upon the importance of the "human factor" in engineering, saying: "As engineers constitute an increasingly influential group in modern industry and government, all member companies are concerned that the schools shall ground them in sound principles and equip them with sound methods in their relations to social and economic questions. There is a need that engineers shall attack these questions with the same unprejudiced fact-finding, analytical methods they have used with such marked success on material problems. As a balance to these dispassionate, scientific methods there is an equal need among engineers for sympathetic insight into human motives and aspirations and an understanding of the principles which underlie governmental, business and industrial organization."

The report commended the United States Bureau of Education for promoting closer relations between education in business and in engineering and asserted that corporations should aid the country's engineering colleges by contributions to funds for plant and equipment, to general endowments and to current expenses; by endowment of chairs and lectureships and for research; by specific grants for research, establishment of scholarships, employment of teachers for expert services by financial arrangement with the college, and by the use of influence in campaigns for endowment or increased public support.

"The engineering colleges have a strong claim on the assistance of the industries in return for services rendered," continued the report. "The schools have made inestimable contributions to scientific knowledge from which the industries have profited without cost. Education has increased earning power and so has made possible the markets on which many industries depend for existence. The colleges have expended on each engineering graduate from $800 to $2,000 above all fees received. The industries profit by this training and would be compelled to provide costly substitutes for it if it were not available."

Safety Switches Discussed

The desired qualifications for safety switches were brought out in the safety switch conference held on Nov. 3 by the Philadelphia Section of the Association of Iron and Steel Electrical Engineers. All agreed that the safety switch had advanced greatly in design but that there were some features which needed improvement. An exhibition of safety switches by twenty manufacturers was examined with much interest by the engineers present.

A talk on the advantages of safety switches and points to consider in their selection was given by P. T. Vanderwaart, electrical engineer for the New Jersey Zinc Company. Among the points to consider in looking into switches Mr. Vanderwaart named the following: (1) Are all live parts inclosed? (2) Is it externally operated? (3) Is it possible so to connect it that the safety features are inoperative? (4) Is its construction suitable for the location? Dust-proof? Weatherproof? Vapor-proof or acid-proof? (5) Are all parts strong? (6) Is it tamper-proof? (7) Can the unit or parts be quickly removed, replaced and repaired? (8) Is there ample wiring space? (9) Facility for conduit or open wiring connections? (10) Is provision made for easily connecting test instruments into circuit? (11) Can switch be locked in "off" position? (12) Is it possible to open door with switch closed? (13) Is it possible to close switch with door open, even if interlock is manipulated by hand? (14) Is it possible to touch "live" terminals when door is open? (15) Is it possible for authorized inspector, and he only, to inspect all parts without interrupting service? (16) Is accidental closing of switch probable or possible? (17) Can "disconnect" be opened under short circuit? (18) Positive make on closing? (19) Quick make? (20) Contact resistance liable to become excessive? (21) Is rupturing capacity sufficient for short circuit? (22) Characteristics of overload device? Effect of zero weather? Adjustable settings for time limit and minimum current to trip? Current time-limit characteristic curve? What deviation is tolerated? Is non-automatic reset furnished for under-voltage-release service? Volt-amperes? Watts? Temperature rise? (23) Is operation of double-throw motor-starting switch positive? (24) Is switch furnished for under-voltage protection? For under-voltage release? (25) Characteristics of operating coil: Volt-

amperes? Watts? Temperature rise? One defect in safety switches mentioned by George W. Richardson, Pencoyd Iron Works, was that blades sometimes pull loose from the handle and keep the circuit closed while externally the switch appears to be open. H. W. Moser, Ballinger Company, and J. R. Bower, American Car & Foundry Company, said that the small sizes of safety switches give general satisfaction. It was the consensus of thought, however, that the large sizes are still imperfect. That the development for severe service should be along the lines of the circuit breaker or the magnetic contactor was the opinion of both J. R. Bower, American Car & Foundry Company, and A. H. Allen, consulting engineer, Philadelphia.

A. S. M. E. Meeting to Include Four Joint Sessions

A feature of the annual meeting of the American Society of Mechanical Engineers, to be held in the Engineering Societies Building, New York, Dec. 4-8, will be joint sessions with the American Economic Association, the American Society of Safety Engineers, the American Society of Refrigerating Engineers and the American Engineering Standards Committee. These sessions are expected to attract engineers, manufacturers, economists, educators and industrial managers from all parts of the country.

L. F. Loree, president of the Delaware & Hudson Company, and E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, will be among the speakers at the economic forum, at which addresses will also be delivered by Dr. W. C. Mitchell of the National Bureau of Economic Research and professor of economics at Columbia University; Prof. H. R. Seager of Columbia, president of the American Economic Association, and Dean Dexter S. Kimball of Cornell.

It is officially announced that John L. Harrington of Kansas City will at this meeting succeed Dean Kimball as president of the A. S. M. E.

Educational Aspects of Power Exposition

The national exposition of power and mechanical engineering, which will open at the Grand Central Palace, New York, on Thursday, Dec. 7, following the annual meeting of the American Society of Mechanical Engineers, will be the first large-scale attempt to display mechanical and power-plant apparatus so that the present state of development will be apparent not only to the technical man but to the layman as well. The development of the electric power station will be illustrated by models of central stations in New York City, the original station erected by Edison in Pearl Street appearing beside the Waterside stations and the recent Hell Gate station, which will be a faithful reproduction built to a scale of one-quarter inch to the foot and showing the steam and electric apparatus and the various boiler-room and turbine-room auxiliaries as well as the machinery for handling coal and ashes. It is planned also to show a model of a large industrial power plant.

Fuel Economy in Europe

Smokestacks in Germany contribute a striking feature to the skyline of each industrial community because of their unusual height. This fact impressed O. P. Hood, the chief mechanical engineer of the Bureau of Mines, who recently returned to the United States after an economic survey of the power and fuel situations in several of the European countries. Mr. Hood was particularly impressed, however, by the fact that no smoke issues from these tall chimneys. He knew there was feverish activity in these plants and that the fireboxes which the smokestacks served were being called upon to furnish their maximum of heat. The fact that smoke rarely is seen above a German industrial plant is the best indication, Mr. Hood points out, that the Germans have learned how to prevent waste of fuel and affords a striking contrast to the smoking plants of America.

Mr. Hood believes American industry could profit enormously by a study of German firing practice. The average German plant burns a fuel having but one-third of the heat value of the commercial coal used in America. Briquetting is resorted to at almost every European coal mine, and after studying foreign processes and methods of distribution, Mr. Hood is more convinced than ever that our large annual waste of fine coal could be greatly reduced by a more general resort to briquetting here.

Mr. Hood is also much impressed with the large expenditure made by the British government at a great laboratory at Greenwich which is devoted exclusively to problems of coal carbonization. As a result the English are well advanced on a work in which this government has not even made a start.

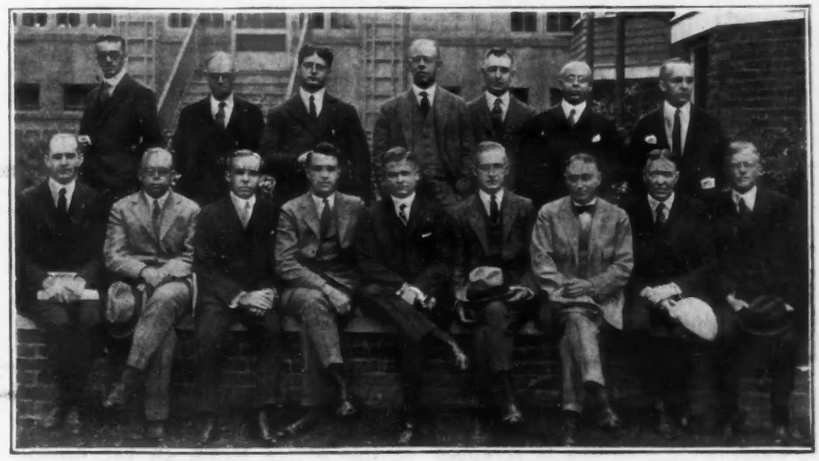
Texas Power & Light Plans a Big Plant on Colorado

The Texas Power & Light Company is investigating conditions with a view to building a mammoth power plant on the Colorado River in the lignite field of Bastrop County, Tex., according to W. B. Head, chairman of the board of directors. Government surveys show that Texas has more than one-half the lignite supply of the United States and that the strata near Bastrop are of good quality and of almost unlimited extent. It is believed that lignite can be successfully used for fuel in a great plant on the Colorado River which can supply power for all the central Texas cities and towns supplied by the Texas Power & Light Company.

The company has recently completed negotiations for taking over the municipal light and power system at Austin, Tex., one of the conditions being that the Austin distribution system be connected with the transmission system of the company. This company's high-tension lines, which now extend south to Taylor, 30 miles from Austin, will be prolonged to Austin.

Street Lighting Corps of New York District, G. E. Company

BELOW is shown a group of street-lighting specialists of the New York district of the General Electric Company who met recently at Swampscott, Mass., to discuss their business problems. The study that is being given to the subject of street lighting is evidenced by the size of this group. The New York district of the General Electric Company includes only the State of New York with small sections of New Jersey, Pennsylvania and Connecticut and comprises only 2 per cent of the area served by the company. Meetings of this kind are held from time to time by the specialists of each district.



Front row: J. A. O'Neill, P. S. Bailey, W. D. Jennings, C. B. Grundy, A. W. Lunn, L. Wintner, A. D. Babson, C. J. Dempsey, G. N. Chamberlain. Back row: T. Whyte, F. W. Ralston, I. S. Crocker, R. R. Birge, W. L. Harradon, C. A. B. Halvorsen and A. D. Cameron.

Brief News Notes

Poteau Plant Purchased by Oklahoma Gas & Electric.—The Le Flore County Gas & Electric Company has been purchased by the Oklahoma Gas & Electric Company. R. E. Baird will remain as manager at Poteau. This plant will eventually become a part of the big system which will be served by the three-million-dollar plant now being built by the Oklahoma Gas & Electric Company near Muskogee.

Muscle Shoals Records to Have Wide Distribution.—The printed record of the Muscle Shoals hearing conducted by the Senate committee on agriculture and forestry during the last session of Congress is to be widely distributed. Accompanying the record will be a letter signed by Senator George W. Norris of Nebraska, the chairman of the committee. which summarizes his arguments against the adoption of the development plans advocated by Henry Ford and his congressional supporters.

Work Started on High-Tension Line in Oklahoma.—Construction work has been begun on the 66,000-volt transmission line of the Oklahoma General Power Company, a subsidiary of the Oklahoma Gas & Electric Company, which will connect Fort Smith, Ark., with Muskogee and other Oklahoma cities. This line will be completed by Dec. 1. It will pass through Muldrow, Sallisaw, Vian, Gore and Webbers Falls and will distribute power into Oklahoma from the new three-million-dollar power house near Muskogee on the Arkansas River.

One Word Can Go to Europe by Radio for Six Cents.—For the first time in the history of international communication, the Radio Corporation of America announces the public can send a short message to London or to Germany at a rate comparable with postage charges. The rate announced is 6 cents a word with no minimum requirement. Thus it is now possible for individuals or business houses to send, say, a two-word message, as, for instance, "All well," for only 12 cents plus charges for address and for signature, if any.

Electric Annealing Furnace.—A demonstration was recently given before a large party of engineers at the Canadian National Railway shops in Transcona, Manitoba, of a newly installed electric furnace for annealing parts of locomotives. Expert opinion, according to J. I. Brittain, United States Consul General at Winnipeg, was to the effect that the demonstration was satisfactory in every way and that the furnace proved its economy, as by the annealing process many parts of the locomotive which might otherwise be scrapped can be reclaimed. The furnace is the first of its type to be installed in Canada.

Northern New York Companies Merge.—A certificate filed with the State Department of New York announces the merger of the Ballston Spa Light & Power Company, the Glens Falls Gas & Electric Light Company and the Consolidated Light & Power Company of Whitehall with the Adirondack Power & Light Corporation of Amsterdam.

Genesee Light & Power Absorbs Le Roy Company.—Announcement is made that negotiations have been concluded for the sale of the business and equipment of the Le Roy (N. Y.) Hydraulic Electric-Gas Company to the Genesee Light & Power Company of Batavia. The transfer will be made as soon as the Public Service Commission formally approves the sale. The acquisition of the plant by the Genesee company means the entrance of Niagara power into Le Roy and the surrounding country.

Tidewater Power Company Buys Three Utilities.—Purchase by the Tidewater Power Company of Wilmington, N. C., of the St. Petersburg Lighting Company of St. Petersburg, Fla., the Clearwater Lighting Company of Clearwater, Fla., and the Commonwealth Light & Power Company of Missouri has recently been announced by A. E. Fitkin, president of the Tidewater company. A bond issue of $4,000,000 will be floated by the Tidewater company to take care of its purchase and other improvements, which add eighty-five communities to the list of those now served by this corporation.

X-Ray at 200,000 Volts.—A demonstration of a new X-ray apparatus built by the General Electric Company on plans worked out by Professors Hull, Collidge and Davis was made at the Croker cancer research laboratory at Columbia University, New York, last Sunday. It is intended to use this X-ray apparatus, described as the most powerful ever built, in the treatment of cancer. It is so powerful that no one is admitted to the room where it is producing rays. The machine will, it is asserted, drive rays through a quarter of an inch of lead, a foot of aluminum and two feet of brick. It will photograph the bones of the hand at a distance of many feet.

Good Record of Electrically Driven Ship.—An extremely low maintenance cost of propelling machinery in spite of severe service, which included the towing of a vessel nearly 1,000 miles, is the performance of the ship *City of Weatherford*. The records of this 9,000-ton vessel show that she traveled 73,956 miles in the past two years and that the total cost of repairs to her Westinghouse geared-turbine propelling machinery in that period amounted to less than $1,000. On her latest trip, which was from Hull, England, to New Orleans, she towed the *Federal*, also a 9,000-ton ship, to Mobile Bar. In spite of this severe strain on her driving equipment, an inspection made after the trip showed that the machinery was in first-class condition.

Associations and Societies

Electrical Supply Jobbers' Association, Pacific Division.—The regular quarterly meeting of this division will be held at the Hotel Coronado, Coronado, Cal., on Dec. 7, 8 and 9.

Taylor Society.—The Taylor Society will meet at the Engineering Societies Building, New York City, from Wednesday to Friday of next week, Nov. 22 to 24. Organization and management of a medium-size plant, statistical compilation, master budgets of sales and production, reduction of waste and supervision of personnel are among the topics announced.

Coming Institute Meetings.—Some of the meetings of A. I. E. E. sections still to be held this year are: Akron, Nov. 28, "The Story of an Electric Meter," by R. J. Andrews, Sangamo Electric Company; Boston, Nov. 23, "Commercial Aërial Development," and Dec. 12, "Standards — Accomplishment, Trend and Goal," by P. G. Agnew, with discussion by Comfort A. Adams, D. C. Jackson and others; New York, Nov. 24, "The Electrical Engineer on Shipboard," by G. A. Pierce of William Cramp & Sons; Philadelphia, Dec. 11, "Machine Switching," by F. J. Chesterman; Pittsfield, Nov. 23, "Grinding and Abrasives," and Dec. 5, "In Unknown Baffin Land"; Schenectady, Dec. 1, L. T. Robinson, director General Electric engineering laboratory; Toronto, Nov. 24, "Grounded Versus Ungrounded Neutral"; Worcester, Dec. 21, "Vacuum Tubes," by H. H. Newell, Worcester Polytechnic Institute.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Electrical Supply Jobbers' Association—Cleveland, Nov. 20-24. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Physical Society—Chicago, Dec. 1 and 2. D. C. Miller, Case School of Applied Science, Cleveland.

American Society of Mechanical Engineers—New York, Dec. 4-8.

Electrical Supply Jobbers' Association, Pacific Coast Division—Coronado, Cal., Dec. 7-9. A. H. Elliot, 502 Flatiron Bldg., San Francisco.

New York Electrical Credit Association—New York, Dec. 14. W. J. Kreger, 47 W. 34th St., New York.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Recent Court Decisions

"Proximate Cause" Defined.—"Proximate cause," said the Supreme Court of Appeals of Virginia in a recent damage suit, "is a superior or controlling agency as distinguished from those causes which are merely incidental or subsidiary to such controlling or practical cause, and it does not necessarily imply closeness or nearness in point of time or physical sequence of events, but rather closeness or nearness in causal connection." (113 S. E. 711.)*

Appeal from Former Rate Order Does Not Prevent Commission from Passing on New Application Based on Different Facts.—In City of Bluefield vs. West Virginia Public Service Commission the city sought to prevent the commission from hearing an application for a temporary increase in the rates of a water company because a previous hearing had resulted in an increase with which the company was not satisfied and there had been an appeal to the courts which finally awaited adjudication in the United States Supreme Court. The West Virginia Supreme Court of Appeals has overruled the city's contention and declared that the commission has jurisdiction to fix a temporary rate based on different facts from those previously alleged. (113 S. E. 745.)

Minimum Wage Law Declared Invalid.—The Court of Appeals of the District of Columbia has declared unconstitutional an act passed by Congress fixing a minimum wage for woman workers in the District. Holding that if Congress may establish a minimum wage for women, it may also establish a maximum wage for men, the court denies that the act is a proper exercise of police power. "No greater calamity could befall the wage earners of this country," it says, "than to have the legislative power to fix wages upheld. It would deprive them of the most sacred safeguard which the Constitution affords. Take from him the right to freely contract and sell his labor for the highest wage which his individual skill and efficiency will command, and the laborer would be reduced to an automaton—a mere creature of the state. It is paternalism in the highest degree, and the struggle of the centuries to establish the principle that the state exists for the citizen, and not the citizen for the state, would be lost. . . . The modern tendency toward indiscriminate legislative and judicial jugglery with great fundamental principles of free government, whereby property rights are being curtailed and destroyed, logically will, if persisted in, end in social disorder and revolution. Let no one imagine for a moment that our civilization is such that property rights can thus be socialized without the grossest abuse of the privileges granted, or that the restraint of the abuses can be left with safety to legislative or judicial discretion."

Deliberate Negligence of Lineman Bars Recovery of Damages.—Asserting that where an experienced lineman undertook to transfer wires to a new pole in the midst of a network of wires, some carrying a deadly current, without grounding them, as required by a rule of his employer, and in the absence of any showing of an extraordinary situation requiring the sudden exercise of judgment or discretion, he was guilty of negligence, the Supreme Court of Arizona reversed a verdict for damages obtained in Hayes vs. Arizona Power Company. Testimony that the lineman was doing the work in the usual manner and that it was the practice of linemen to take the risk he incurred did not, the court held, excuse the violation of the rule or prove acquiescence therein by the employer. (209 Pac. 280.)

When Must Question of Contributory Negligence Go to Jury?—In Winters vs. Calumet & Arizona Mining Company damages were sought for the death of an electrical worker who in some way came into contact with electric current while employed in wiring a switchboard. The defendant company introduced evidence to show that the only possible way in which the contact could have been made was by the deliberate act of the victim in reaching behind a board erected for protection and touching a fuse terminal. On the other hand, a fellow workman testified that he and the man killed were standing close together when the accident occurred, both engaged in bending a wire, and that he did not see the decedent touch the fuse terminal or put his hand back of the board. The Supreme Court of Arizona refused to reverse a verdict for the plaintiff, declaring that the question of contributory negligence was, on the testimony, rightly submitted to the jury. (209 Pac. 298.)

Federal Permits for Electric Lines Across Indian Reservation Not Terminated by Issue of Patents to Land Crossed.—In Swendig et al. vs. Washington Water Power Company the United States Circuit Court has affirmed the judgment of the District Court in favor of the appellee and forbidding interference by the appellants with its high-tension transmission lines or its telephone lines crossing a former Indian reservation on the route of the company's Spokane-Boise system. Right to carry these lines across the reservation was granted, under the federal law, by the Secretary of the Interior in 1902. In 1906 the reservation was opened to settlement, and the contention of the appellants was that by the issuance of patents to them the United States government automatically canceled its authorization of the company's right-of-way. The courts have found that in the absence of any revocation of the permits originally granted the rights granted by the Secretary of the Interior were not terminated and that the patents to land subsequently issued were subject to them. (281 Fed. 900.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

"Deficit Method" of Determining Development Cost Condemned.—In adjusting gas rates for the Pacific Power & Light Company the Oregon Public Service Commission said that the "deficit method" of determining development cost, which includes operating losses even back into the pre-regulatory period or which permits past poor management to be an increment of value, does not justify serious consideration, but a practical allowance for this cost may be made by estimating the deficit in return experienced in the period next following construction during which the reasonably expected business is being acquired.

Is a Connection Charge of $500 to Rural Customers Too Great?—The Wisconsin Railroad Commission in adjusting rates for the Fall River Light & Power Company characterized the company's contract connection rate of $500 as "rather high," but pointed out that if twelve additional customers along the present line were secured, the charge would be reduced to $293. "The company has stated," the commission observed, "that it does not expect the rural consumers on the present lines to contribute further toward the cost of the main lines and that future connection charges will be divided among the consumers then on the line. This appears to us to be an equitable arrangement."

Normal Construction Period.—In evaluating an acquisition to a municipal utility at Oroville, Cal., the California Railroad Commission pointed out that estimates must be predicated upon a normal and reasonable construction period under normal and reasonable construction conditions and that this rule must have its influence on labor and material cost and on the so-called overhead allowances applied to an inventory. "No public utility plant of any size can be built in one day," said the commission. "It is true a contractor may submit a bid for a piece of construction as of a particular day and may be held to the contract price. But this test does not meet the issue. The contractor, before he makes the bid, will of necessity have to estimate upon an expected construction period and will have to take into consideration expected costs of labor and material and overhead during such construction period."

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Dr. Wheeler Sails to Investigate Conditions Abroad

Dr. Schuyler Skaats Wheeler has sailed on the *Homeric* for Europe. He will be one of the American representatives at the annual congress of the International Electrotechnical Commission, which opens at Geneva, Switzerland, next week. He will be accompanied by his wife and will spend several months abroad investigating conditions in electrical centers. Dr. Wheeler is a former president of the American Institute of Electrical Engineers. In addition to his mission at the electrotechnical congress, he will attend a number of meetings of scientific societies interested in electrical manufacturing and its problems and will be the guest of the leading societies in the countries to which he has been invited.

S. S. WHEELER

Charles A. Dean has been appointed manager of the appliance department of the Connecticut Light & Power Company, Waterbury, Conn. Mr. Dean is well known in New England central-station circles, having been merchandising manager of the Cambridge (Mass.) Electric Light Company for a number of years and more recently manager of the Middlesex County Electric Company, East Pepperell, Mass.

E. C. Deal, general manager of the Springfield (Mo.) Gas & Electric Company, which is controlled by the Federal Light & Traction Company of New York City, has recently returned to Springfield after a business trip to New York. According to the plans which the Federal Light & Traction Company has under consideration, Mr. Deal will be required to spend much of his time looking after properties in other cities. Heretofore he has confined his activities to the Springfield office, with which he has been associated for five years.

Dr. Albert Einstein of Germany, identified with the theory of relativity, has been awarded the Nobel prize for physics for 1921 by the Stockholm committee which has charge of distributing the prizes under the Nobel foundation.

Gelasio Caetani, the recently appointed Italian Ambassador to the United States, is well known among American engineers. Immediately after his graduation from the University of Rome, where he completed the course in civil engineering, he came to the United States and entered Columbia University. There he took the complete mining engineering course and then went to California, where he joined the staff of F. W. Bradley. Later Mr. Caetani formed a partnership with Albert Burch and Oscar Hershey. This firm did a flourishing consulting business, with headquarters in San Francisco. When war was declared Mr. Caetani retired from the partnership and returned to Europe.

William Baum, president of William Baum & Company, consulting industrial engineers of Milwaukee, has been appointed vice-president of the National Society of Industrial Engineers in charge of research. Mr. Baum has been a resident of Milwaukee for a number of years. Just prior to his founding the company which bears his name he was for several years research engineer of the Milwaukee Electric Railway & Light Company. From 1915 to 1917 he was dean of the School of Engineering of Milwaukee. From 1903 to 1915 he was with the General Electric Company, where he was closely associated with Dr. Steinmetz. He has a number of inventions in electricity to his credit which are now used in the home and the industrial world.

Dinner to English Engineer

A group of about thirty-six engineers gathered at dinner at the Engineers' Club in New York on Friday, Nov. 10, as guests of the New York Edison Company, in honor of W. H. Patchell, vice-president of the Institution of Mechanical Engineers (of Great Britain). Mr. Patchell will sail for England on Nov. 25 after a two months' stay in this country, where he has been investigating American central-station practice and acting as an adviser to some American central-station companies, particularly the Detroit Edison Company. Mr. Patchell is well known for his pioneer work in the steam end of central-station work.

F. F. Rohrer Made Westinghouse General Contract Manager

F. F. Rohrer, assistant to manager of both the power and railway departments of the Westinghouse Electric & Manufacturing Company, has been appointed general contract manager of the company. Mr. Rohrer, who was born in Harrisburg, Pa., in 1876 and attended school there until 1895, entered the employ of the Westinghouse company as a student in 1896. After serving in the shops for four years, where he obtained extensive training in the manufacturing and testing departments, he was transferred to the sales department, where his services have included a number of positions of responsibility. During the world war Mr. Rohrer was a member of the committee of the War Industries Board appointed to conserve the production of turbo-generating equipment for government needs. After the armistice he became the representative of the Westinghouse company in the settlement of contracts which were terminated as a result of the ending of the war. In his new position Mr. Rohrer assumes responsibility for service to customers under contracts and will have general supervision of all contract and order work of the company. In addition, he will continue to have direct charge of the contract work of the power and railway departments, duties which he performed in his previous position.

F. F. ROHRER

H. M. Camp was recently appointed lighting sales manager for the Chattanooga division of the Tennessee Electric Power Company, succeeding L. J. Wilhoite, who has resigned after thirteen years' service with the company to assume the position of advertising manager of the Chattanooga *Times*. Mr. Camp has been associated with the company since 1917, when it was known as the Chattanooga Railway & Light Company. He was exceptionally successful as salesman and was promoted to assistant lighting sales manager in February, 1921. He has held that position until the present time.

A. E. Baron, formerly assistant to the comptroller of the San Joaquin Light & Power Corporation, is now connected with the Southern California Edison Company's stock sales department.

J. S. Pevear, manager of the Birmingham Railway, Light & Power Company, was recently appointed co-receiver of this company with Lee C. Bradley, who will take a long trip on account of ill health.

F. D. Van Winkle is now president of the Mount Hope Electric Power & Water Company, Mount Hope, W. Va., replacing George A. Waldo, who was president and manager. A. M. Rosenblatt has become the general manager.

Allan A. Searle, formerly assistant treasurer and auditor of the Bronx Gas & Electric Company, has been advanced to the position of secretary. Mr. Searle resigned as statistician of the Westchester Lighting Company, Mount Vernon, N. Y., in March, 1918, after having been with the organization nine years, to become associated with the Bronx Gas & Electric Company.

John P. McGreevey, superintendent of the Utica Gas & Electric Company in Little Falls and Herkimer County, N. Y., has been promoted to the position of general superintendent of the entire district surrounding Utica. Mr. McGreevey has been superintendent of the Herkimer County district for several years and was formerly in Ilion. Mr. McGreevey's headquarters are in Utica.

Harry D. Stokes has resigned as power engineer of the Worcester (Mass.) Electric Light Company and will soon enter the electrical supply and contracting field at Rochester, N. Y. Mr. Stokes is widely known in New England central-station circles and also in the other branches of the industry, having served as chairman of the Worcester branch of the National Association of Electragists.

J. W. Carpenter, vice-president and general manager of the Texas Power & Light Company, with offices in Dallas, addressed the Rotary Club of Brownwood, Tex., on community building recently, pointing out that the greater the number of users of electricity in a community the greater the convenience and the lower the cost. The speaker urged community co-operation in electrification.

Edward D. Learned has been appointed head of the power sales engineering department of the Worcester Electric Light Company, succeeding H. D. Stokes. Mr. Learned was educated at the Worcester Polytechnic Institute and after about six months' experience with the Dublin (N. H.) Electric Company joined the power sales staff of the Worcester company, where he has been for the past ten years. Of late he has given special attention to industrial electric heating problems in addition to the sale of commercial power in the Worcester company's territory.

W. W. Sayers of the Link-Belt Company has recently been promoted to the position of chief engineer of the company's Philadelphia works and Eastern operations. For many years Mr. Sayers has been the representative of the company in the Chicago territory in the lines related to power-house machinery, coal storage, Peck carriers, crushers, etc., and later in charge of the locomotive-crane department. His headquarters will be in Philadelphia.

Officers of the Denver Electrical Co-operative League

The Denver Electrical Co-operative League has selected as chairman of the advisory board John J. Cooper, head of the Mountain Electric Company and long recognized as one of the leaders

J. J. COOPER

of the industry. Mr. Cooper succeeds E. C. Headrick. The new chairman is a director of the Rocky Mountain Utilities Committee and is the head of several public service organizations in the state. He was one of the organizers of the league in Denver.

Charles N. Shannon of the Shannon electrical firm was chosen vice-chairman; R. W. Elliott, sales manager of the Albert Sechrist Manufacturing Company, secretary, and O. L. Mackell, chief clerk of the Denver Gas & Electric Light Company, treasurer.

The advisory board will include, in addition to the officers, N. E. Lawrence, B. C. Watts, J. C. Davidson and J. W. Ryall for the jobbers; J. Fischer, E. A. Scott and E. C. Headrick for the contractor-dealers; H. Alex Hibbard, G. O. Hodgson and J. P. Sprunt, Jr., for the manufacturers, and R. G. Gentry, Clarence Keeler and F. F. McCammon for the central station.

C. E. Skinner, assistant director of engineering of the Westinghouse Electric & Manufacturing Company, has been reappointed a representative of the American Institute of Electrical Engineers upon the American Engineering Standards Committee for a term of three years commencing Jan. 1, 1923.

W. M. Green, engineer for the United States Reclamation Service, in charge of investigations of various possible reclamation projects in Utah, is at present engaged in compiling and writing his report on the Weber and Ogden River end of the so-called Provo-Weber project. He will submit this as a separate unit of his complete report to F. E. Weymouth, chief engineer for the service. Another report will be made later on the Provo River, and also one on the Tooele County end of the project. In addition, a report will be made on the Dead Man's Bench project, on the lower White River, in Uintah County, where the field work is now being completed in charge of R. R. Robertson.

Obituary

William A. La Due, division superintendent of the Public Service Electric Company, Jersey City, N. J., died recently. He had been in electrical work in Jersey City for many years.

Thomas S. Haddaway, engineer for the steam engineering department Union Electric Light & Power Company, St. Louis, died after a brief illness recently at his home in Webster Groves, Mo.

C. F. Larzelere, vice-president of the American District Telegraph Company in Brooklyn, N. Y., from 1902 until 1910, died there recently in the Methodist Episcopal Hospital. Mr. Larzelere was connected in many enterprises with the late Dr. Louis Kloepsch.

J. Buntzen, who was the first general manager of the British Columbia Electric Railway Company, died recently at Copenhagen, Denmark, the place of his birth. In 1890 Mr. Buntzen left Denmark and settled in Vancouver, B. C. He became associated with the Vancouver Electric Railway & Lighting Company, which later went into bankruptcy and was acquired by English capitalists, together with other bankrupt electric railways of New Westminster and Victoria. The new concern was known as the Consolidated Railway & Light Company, and Mr. Buntzen became its business manager. The company was then sold, and after it was forced into liquidation the British Columbia Electric Railway Company, Ltd., was organized to take over the business. In 1898 Mr. Buntzen became general manager. During eight years of strenuous labor, when the franchises of the company were in a chaotic condition, he accomplished remarkable results. When a partial failure in health compelled him to give up office in 1905, the board of directors made him managing director with headquarters in London, a position which he held for some years, and he was still retained in an advisory capacity when he died. Mr. Buntzen was sixty-three years of age.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Cost in Selling Washing Machines

By E. B. SEITZ

Secretary American Washing Machine Manufacturers' Association

JOHN F. GILCHRIST, vice-president Commonwealth Edison Company, Chicago, recently presented two papers before electrical conventions discussing central-station merchandising costs and policies. In these papers, which have both been published in the *Electrical World*, he submitted figures on the cost of selling appliances by nine large central stations, showing that they are all suffering large losses on their merchandising activities. Mr. Gilchrist cited as a detailed example the cost of selling electric clothes-washing machines in the Commonwealth Edison Company's electric shop. He urged better cost accounting by central stations and recommended that prices should be raised to produce a profit. The manufacturers of washing machines have taken exception to the washing-machine figures given by Mr. Gilchrist, holding that they are not representative of proper selling costs according to the best practice, and while heartily indorsing his plea for a better knowledge of merchandising expense, submit this brief in rebuttal. It is published as a further valuable contribution to this important discussion.

Mr. Gilchrist's paper was in no sense a reflection upon the washing-machine industry. It was a deliberate and courageous effort to focus the attention of the central-station industry on the facts which he has uncovered. It is perhaps unfortunate that he cited specific figures on only one appliance and that this discussion has centered on washing machines, when the principle at issue involves all appliances and what is needed is cost facts on central-station and dealer merchandising throughout the country. The Gilchrist papers and this statement should be studied by every central-station executive, for merchandising efficiency, adequate turnover and the pricing of goods must all be based on a true knowledge of what it does cost and should cost to sell.

THIS is no attempt to start a controversy by debating with John F. Gilchrist the various issues raised by him in his recent address at French Lick Springs before the Great Lakes Division of the National Electric Light Association, which address was printed in the *Electrical World*. My purpose in issuing this statement is twofold — first, to emphasize the gospel truth of the major part of Mr. Gilchrist's views as expressed in this address; second, to point out wherein, in my judgment, Mr. Gilchrist is in error.

It is after considerable hesitation that this statement is given to the public, this hesitancy having been based on an unwillingness to detract one jot from what I interpret to be Mr. Gilchrist's real purpose, that is, to impress on central-station companies the imperativeness of a separate accounting of their commercial business and their regular energy-selling business. And if Mr. Gilchrist had not singled out washing machines and had not shown the very expensive operation of the Commonwealth Edison Company in merchandising washing machines, and had there not been such widespread publicity given to his address which contained the statements concerning washing machines, this article would not have been prepared.

Points in Agreement. — Both manufacturers and those engaged in selling will, I believe, agree with Mr. Gilchrist on the following points:

1. That central stations can be leaders in appliance merchandising.
2. That central stations should co-operate with and encourage independent dealers and should set a pattern of ethical and profitable conduct of business.
3. That merchandising of appliances should be done at a profit above all charges which would prevail in a separately maintained business, provided, first, that the division of overhead is reasonable, and, second, that there is aggressive salesmanship.
4. That business should be vigorously pushed by using advertising and outside sales force.
5. That washing machines are a specialty and must be merchandised as such.
6. That retailers should know their cost and understand what "spread" is necessary.
7. That there is danger of educating the public to a fictitious price that cannot in reason endure.
8. That price is not such an essential as many believe it to be, for it has been proved that low prices will not necessarily produce volume.
9. That central stations can obtain a volume on appliance sales equal to the sale of electricity to residence consumers.

In discussing more fully the above-named points of agreement it should be noted that the central station that is going seriously about the business of selling appliances and has a commercial manager who is trained in merchandising is for the most part a leader in the community in appliance merchandising.

The Real Co-operation.—Central stations can develop a very friendly co-operative spirit with independent dealers as the Commonwealth Edison Company in Chicago has done. It is good business from the standpoint of selling energy to encourage the scores of smaller dealers in each community to help load the lines during that part of the twenty-four hours that is usually a valley in the load curve of the system. But it is an impossibility to develop such co-operation if the central station company is a "price cutter" and fails to conduct its appliance business under a "live and let live" policy.

It has been my observation, especially in smaller communities, that in the past much of the opposition to central stations in their applications for a revision of their rates has emanated from the independent dealers of electrical merchandise because the dealers have been incensed over the merchandising policies of the central station. This is fast being remedied, and it is much to be wished that for the sake of the great electrical development program of this country the

broader co-operative spirit shall universally supplant the selfish one.

Dividing Overhead the Problem.—In the segregation of accounts, or, in other words, in making a business stand on its own foundation, comes the very intricate question of dividing overhead. Since the cost of promoting energy sales and the expense of appliance merchandising are interwoven so thoroughly, the point of division remains too much a matter of opinion. Perhaps no agreement can be arrived at nor any solution found until figures are obtained not only from central stations but from allied lines selling appliances. I think it is apparent that this is both the rub and the crux of the entire matter. Overhead is such a large percentage that one can show either a profit or a loss on this separated appliance business by his determination of just how overhead is to be divided. When all of these data—which we hope will be collected—are obtainable, this segregated central-station appliance business can not be compared exactly with that of a dealer unless there has been just as aggressive salesmanship on the part of the central station as there has been on the part of the independent dealer.

MANUFACTURERS MUST BE PROSPEROUS

Satisfactory Profits Necessary.—Washing machines are not self-selling staples. This has been brought very much to mind since we have entered a buyers' market. As regards the merchandising treatment which washing machines can receive, retailers must know positively on the basis of their margins to what expense they are able to go to obtain volume. Manufacturers of washing machines are just as desirous as any other group that dealers shall know their cost. The growth of the industry depends upon the satisfaction and prosperity of those engaged in the manufacture and distribution of its product. There can be no argument on this point.

Standardizing a Fictitious Price.—There is not yet in the minds of the public a standardized price on washing machines. There is grave danger that the public may be educated to a price that cannot permit of the manufacture and merchandising of washing machines at a profit. There has been genuine interest in watching the experiment of the Commonwealth Edison Company of lengthening its "spread" on washing machines, but it is to be regretted that the experiment is somewhat upset by the company's having saddled on its washer, as is manifest in Mr. Gilchrist's chart of figures, the enormous burden of a costly merchandising system. Further reference will be made to this subject later.

CONSUMER PAYS COST OF PAYMENT PLAN

Cost of Time-Paper.—Mr. Gilchrist states that "the deferred-payment plan means high cost of financing, for it introduces the cost for carrying of accounts." Yet in his chart of figures he does not show where his company has absorbed any deficit caused by that operation. Then we are to assume that the additional charge of $17.22 contained in the deferred payment price of $192.20 is sufficient, and that in this company's case, as in practically all deferred-payment prices, the real cost of the privilege of paying over a period of months has been passed on to the consumer.

Cost of Doing Business.—The statement is made, first, that it is "suspicioned" that the average cost of doing business was somewhere in the neighborhood of 37½ per cent. Later the statement is made that the cost of doing business *is* 37½ per cent. It is our contention that this quoted figure is a guess pure and simple, for in the absence of segregated accounting, which Mr. Gilchrist so warmly urges, how can it be other than a guess?

"Spread" on Washing Machines.—The alleged absorption of merchandising losses of central stations has not misled manufacturers. If there exists in the washing-machine business too low a "spread" between factory cost and list price, it is a fault that has been handed down since the earliest days of the industry and which existed long before central stations became a factor in the merchandising of washing machines. The manufacturers have not ignored the question of what spread is essential, and our group, at least, has been giving during the past year very active thought and investigation to the study of costs. This forward-looking movement has been undertaken that we may be ready when the time comes for all factors to gather about the conference table.

Price Levels.—While it is quite true that economists and students of affairs say that we are in for a long period of declining prices, this does not apply to electrical appliances in general. Back in the days of the little red schoolhouse, there used to be a saying at the water bucket, when the dipper of water was tossed in the air, "All that goes up must come down on head or ground," but in the case of appliances there has been nothing that has gone up, that is, in relation to prevailing costs. So they cannot be expected to come down.

PRICES ADVANCED 72 PER CENT SINCE 1913

In the period from 1913 to the peak it has been proved that the electrical industry showed an advance of about 72 per cent in prices. Washing machines during this period had an advance of 59 per cent. When this is compared with the peak level of all commodities it appears quite low, and when compared with the present level it is found to be still under the advance of all commodities over 1913. A joint analysis of cost will undoubtedly show that the manufacturer cannot absorb all of any reduction in factory prices.

Are They Losing Money?—I am loath to believe that Mr. Gilchrist subscribes to the content of the letter which he cities as having been received from a Middle West dealer. This is not a typical letter, but an exaggerated case of a dealer who acknowledges that a persuasive salesman "loaded him up." In September, 1922, there were 42,000 electric washing machines sold. How long would the washing-machine dealers of this country continue if they incurred a monthly loss of $345,240, at the rate of $8.22 per machine, or of $1,050,000, at the rate of $25 per machine, which Mr. Gilchrist puts as a maximum for their loss? The fact that, with the exception of July, the sale of electric washing machines has gained each month in 1922 over the sales of the preceding month would further contribute to the belief that dealers on the whole are finding the merchandising of washing machines to be a profitable business. They could not absorb such terrific losses as those mentioned above—that is, from one-third of a million to over one million dollars monthly—and continue to come back for more.

Type of Salesmanship.—While much depends upon the definition of salesmanship, it is seriously doubted

that, be the definition what it may, the statement that "the highest type of salesman's service is required to sell washing machines" can stand as correct. Washing machines have not been sold by highly trained salesmen, and even the very generous commissions indicated as paid by Mr. Gilchrist would not procure the services of the highest type of salesman.

Turnover.—Mr. Gilchrist quite ignores the importance of turnover. Yet making capital work many times is just as sound in the business of selling washing machines as in any other business. It is better to sell monthly twenty machines at a net profit of $5 per machine than four machines at $15 net per machine or one machine at a loss of $5. Also, according to our figures, Mr. Gilchrist is in error when he states that his company is selling over one-half of the washers that are sold in Chicago.

Whose Operation Costs the Less?—The assumption on the part of Mr. Gilchrist that the independent dealer's cost of doing business is greater than the central station's cost of doing business we must disagree with. He states that if independent dealers buy at the same price that central stations do and central stations sell at the same price that independent dealers do, the much larger profit of the central stations could be well spent in assuming greater responsibility in publicity—the advertising of washing machines to the community.

I believe it is quite commonly appreciated among the trade that independent dealers, not having the burden of overhead that central stations have in the past been throwing on their appliances, can merchandise much more cheaply. This higher cost will in the main be equalized when central-station accounting recognizes in the division of the overhead burden the dual capacity of a central station—namely, the two functions of selling energy and merchandising electrical products and appliances that use that energy and produce new consumers for the company. The major part of the overhead burden should attend the first of these two operations, for the executives are engaged largely in fostering and retaining good will for the prerogatives of their company's franchise.

COMMONWEALTH COSTS IN DOLLARS

I believe the most grievous wrong that Mr. Gilchrist has done the washing-machine industry is giving publicity to a chart of figures showing the operative cost of the Commonwealth Edison Company in merchandising washing machines, when that chart does not include more detailed information. Let us look first at the chart of figures reproduced here on the "average cost of selling type 'L' washers," reducing his precentages to dollars and cents.

The comparison is difficult because the chart presents its figures on the percentage basis. A charge of 2.5 per cent for buying in July does not look so bad written as a percentage, but when it is known that this means that the washing machine must carry a cost of $4.37½ for the support of a purchasing department whose sole duty in buying the Federal electric washer consists of ordering from the Federal Electric Company, a company closely allied with the Commonwealth Edison Company, what independent dealer or even central station manager is going to see anything in that load that is comparable with his own case?

Again, occupancy for July is 4.2 per cent, but this in dollars and cents means that for the very high-priced floor space that the washing machine occupies in the Commonwealth Edison's "Loop" and branch stores each must carry the burden of $7.35. In his chart of figures he has allowed for commissions, bonuses, demonstrating, delivery and salesmen's automobiles together with salaries, yet in addition to this comes the administration burden in July of $21.35 per machine. The point of cleavage for all overhead will have to be moved several notches in the opposite direction before the washing-machine merchandisers of this country will have much sympathy for a great company that by its books can show a loss of $24.85 per machine in July as long as that machine carries with it an overhead of $21.35 for administration alone.

TABLE I—AVERAGE COST OF SELLING TYPE "L" WASHER BY COMMONWEALTH EDISON COMPANY

(List Price $175)

	June		July	
	Percentage	Amount	Percentage	Amount
Average allowance	1.2	$2.10	2.9	$4.57½
Average premium	1.7	2.97½	2.5	3.87½
Average cash discount	0.3	.52½	0.6	1.05
Average price reduction	3.2	5.60	6.0	10.50
Average selling price	96.8	169.40	94.0	164.50
Cost of type "L" washer	54.0	94.50	54.0	94.50
Gross profit per type "L" washer	42.8	74.90	40.0	70.00
EXPENSES:				
Selling:				
Commissions	17.8	31.15	18.7	32.72½
Bonus	0.8	1.40	0.8	1.40
Demonstrating	1.4	2.45	1.7	2.97½
Salaries, adjustments and sundries	1.6	2.80	2.2	3.85
Delivery and salesmen's automobiles	4.0	7.00	5.7	9.97½
Repairs	1.1	1.92½	1.6	2.80
Total selling	26.7	$46.72½	30.7	$53.72½
Buying	2.1	3.67½	2.5	4.37½
Occupancy	3.6	6.30	4.2	7.35
Publicity	4.9	8.57½	4.6	8.05
Administration	8.5	14.87½	12.2	21.35
Overhead expenses	19.1	$33.42½	23.5	$41.12½
Total expenses	45.8	80.15	49.4	94.85
Average loss	3.0	5.25	14.2	24.85

ANOTHER CHICAGO RETAILER'S COST

For the purpose of comparison I obtained a chart from the books of another company that is doing a retail business in Chicago. The comparison of these two charts is fair for the reasons that they reflect practically the same amount of business for the month taken, that they cover the same midsummer month, and that in each instance the management of the store is very closely allied with the manufacturer of the machine handled.

TABLE II—COST OF SELLING WASHERS BY ANOTHER CHICAGO RETAILER—SAME MONTH

	Amount	Percentage
Net sales	$52,964.10	100.00
Cost of machine	33,773.40	63.76
Gross	$19,190.70	36.24
EXPENSE:		
Selling:		
Commission	$2,970.11	5.61
Salaries	5,211.66	9.84
Demonstrations	333.44	0.63
Services and repairs	239.38	0.46
Delivery	631.19	1.29
Miscellaneous: postage, telephone, lights, sundries	1,184.81	2.13
Total	$10,570.59	19.96
ADMINISTRATIVE:		
Rent	$3,310.00	6.25
Reserve for bad accounts	264.56	0.50
Advertising	1,689.99	3.19
Insurance	41.00	0.07
Total	$5,305.55	10.02
Total expense	15,876.14	29.98
Net profit	3,314.56	6.26

For further comparison still a third chart is shown which reflects the September operations of a Kansas City store also very closely allied to the manufacturer of the washing machines which it sold.

TABLE III—COST OF SELLING WASHERS BY KANSAS CITY RETAILER IN SEPTEMBER

	Amount	Percentage
Net sales	$17,835.25	100.00
Cost of machines	10,701.15	60.00
Gross	7,134.10	40.00
EXPENSE:		
Advertising	747.50	4.19
Automobile expense	40.87	0.23
Depreciation	87.30	0.49
Freight, express and drayage	268.38	1.5
General expense	183.09	1.02
Telephones, light and water	34.74	0.19
Insurance	27.88	0.15
Interest	175.20	0.98
Office expense (including postage)	39.77	0.22
Rent	376.42	2.11
Salaries	906.82	5.08
Selling expense	1,453.10	8.14
Taxes	41.34	0.23
Discounts	20.01	0.11
	$4,402.42	24.67
Gross profit	$7,134.10	40.00
Total expense	4,402.42	24.67
Net profit	$2,731.68	15.33
Merchandise inventory	$8,960.22	

Where the Solution Lies.—Other charts are obtainable that would reflect much the same story. No doubt, too, Mr. Gilchrist could obtain charts from other large central stations that would reflect expensive operating costs similar to those of the Commonwealth Edison Company, *but to what avail?* The real solution includes the program announced by Mr. Gilchrist, that retailers must set up accounting that will show accurately their cost of operating and that central stations must separate their accounts so as to reflect the true cost of merchandising appliances, but it does not end there. Manufacturers have just as keen interest as the merchandiser in seeing that the accounting system reflects the cost of every service rendered in the merchandising of washing machines, because the spread and the discounts depend entirely on, first, the total cost of all of these services, and, second, on how many of the total services the dealer performs. For it all sooner or later comes down to this: *Discounts on washing machines must be based upon services rendered.* This applies to the jobber as well as to the dealer.

It is wholly unfair that the dealer who waits for a limited amount of business to come to him and obtains it because of the aggressiveness of the other fellow's advertising and the general washing-machine atmosphere that has been created in his community by his competitor should receive the same discounts as those who do sales-creative merchandising. I believe that the time is not far distant when jobbers and dealers in this country will be classified according to the services they are prepared to render and do render, and that discounts will be graded accordingly.

And finally, in the consideration of all that Mr. Gilchrist has said and that I have written here, it must be kept in mind that executives of our country's great central stations must fully comprehend the profound import of this fundamental axiom: "The future of the central-station industry depends upon the invention, development and general application of devices designed to utilize electrical energy in the accomplishment of the tasks of human existence."

Survey of Business Conditions

Printers' Motors Total 53,614, Census Report Shows

Only three lines of industry in the United States exceeded printing establishments in the use of electric motors for power, according to a late census report. The number of offices reporting the use of electricity for power were 12,735. There were more planing-mill customers, a few more bakers and a few more automobile-repair shops, but none of these had as many motors installed. Printers' motors numbered 53,614 and were exceeded only by iron and steel mills and foundries, by cotton mills and by electric shops. All told, 1,483,039 electric motors were working in 237,855 industrial plants in the country, an average of about six per plant.

Tree Lamp Sales Will Be Ten Times Larger than in 1916

Christmas-tree lamp sales in 1922 will be ten times the amount of sales in the year 1916, according to an estimate just issued by the National Lamp Works of the General Electric Company. In 1917 there was an approximate increase of 80 per cent, it is stated. During 1918, the war year, and 1919 the sales rose to over 100 per cent above the 1916 level and soon mounted to the 675 per cent mark. At the end of 1921 sales were at 725 per cent and rising to 850 for later seasons. According to the company, the turnover on Christmas tree lamps is more rapid than two years ago, as people are more and more utilizing these little decorative lamps at other holidays than the Christmas season.

Prevailing Conditions Affecting Cost and Volume

Fuel Situation Stabilized.—The fuel situation has become stabilized to such an extent that the Chamber of Commerce of the United States last week notified its members that the program adopted last September to equalize coal distribution has been successful. The chamber points out the present adequate distribution of supplies and the steady reduction of prices the last few months.

Car Shortage Reaches Record.—A new record in railroad history was established by the report from the American Railway Association showing a shortage on Oct. 30 of 179,239 cars. This was an increase of 12,890 over the previous week's total and compares with 146,070, the high record for 1920, reached on Sept. 1 of that year.

Improvement in Wholesale Distribution.—Reports received by the Commerce Department indicate that the most important development of recent weeks is the marked increase in the demand for goods. Current wholesale business is said to be far in excess of this time last year. Retailers have been buying largely on a hand-to-mouth basis for months and their stocks have been depleted by the renewed buying.

October Construction 14 per Cent Heavier.—Building contracts awarded during October in the twenty-seven Northeastern states, which include about three-fourths of the total construction in the country, amounted to $253,137,000, according to the F. W. Dodge Company. This figure is 14 per cent ahead of that reported in October of last year. The progress of the seasonal decline in October is shown in the drop of 7 per cent from September.

Fewer Failures Reported.—Failures for last week in the United States totaled 387, compared with 407 in the previous week, according to reports received by R. G. Dun & Company. The total for the corresponding week a year ago was 364.

Bank Clearings Gain 9.5 per Cent.—Returns of bank clearings last week, which were for five business days only, show an aggregate of $6,243,834,000 at 20 cities in the United States, as reported to *Dun's Review*, which is 9.5 per cent more than the total for the five-day period of last year.

Late Orders Cause Congestion in Toy Market

The present situation in the electrical toy market is termed unfavorable to both the makers and buyers because of the many orders now being placed, so late in the season.

Last-minute orders for toys continue to be placed with manufacturers, but it appears to be an open question whether most of such business can be filled. In contrast with the situation which prevailed in the toy market last spring, many factories are operating on a day and night schedule in an effort to catch up with demand in the intervening time before the holidays.

The present situation has called forth a large amount of criticism by the manufacturers. The makers claim that the buyers, with the figures of the past year's sales before them, can place orders covering at least 60 per cent of their requirements by June of the year. This, it is said, will result in stability of production and be of marked benefit to the industry as a whole.

South African Electrical Imports Drop 37 per Cent

Imports of electrical materials and machinery into South Africa during the first half of 1922 show a downward tendency, which has been prevalent since the second half of 1920. In fact, the total was only 63 per cent of the figure for the preceding six-month period, which would indicate that the trade must have "touched bottom" and that there should be some recovery recorded in the total imports for the entire year.

In the second half of 1920 imports of electrical materials and machinery were £1,634,428, and in the three succeeding six-month periods they declined to £1,140,780, £735,450 and £442,740 respectively. While the decrease in volume is probably not so great, relatively, because of the lower price levels now prevailing, it is also true that local stocks are about normal, and no great increase in imports can be looked for as the result of a necessity of replenishing low stocks.

The large number of bids received where quotations have been asked for indicates the keenness of competition in the South African market. A recent tender for lamps put out by the Johannesburg municipality brought fifteen offers covering products from six different countries—the United Kingdom, the Netherlands, Germany, Switzerland, Austria and the United States. The total value of this award was only £1,342.

The trade publications of South Africa see a distinct improvement in the local market for electrical supplies, and it is noted that inquiries are numerous and orders increasing. Prices are generally firmer. There is also the promise of considerable expansion in business, in view of the installation of new electric lighting plants and extensions of existing power stations. It is also an encouraging fact that many municipal building schemes, requiring considerable electrical equipment, are still to be completed.

Electric Sign Field Far from Potential Development

The field of electric sign advertising is still far from its potential development, according to first reports received in a survey now being made.

Increasing keenness of business competition, coupled with a growing realization of the value of this form of advertising, is, however, resulting in rapid progress in the electric sign industry.

Sixteen cities, ranging from 5,000 to 340,000 inhabitants, have so far reported in the survey. For a total population of 1,573,000 there are 3,591 electric signs, valued at $1,544,600, a sign investment of approximately $1 per inhabitant. The number of signs per thousand population is 2.28. These statistics are for exposed lamp signs only and do not include translucent letter and glass-faced box signs and illuminated panelboards.

The average value of these signs is $290.60. They represent a total of 618,718 sockets, an average per sign of 173. Figuring on a basis of 10-watt lamps, the total sign load is 6,187 kw., or 3.91 per thousand population.

Portugal Re-establishes ad Valorem Duties

A law published in the *Diario do Governo*, Lisbon, for Sept. 23, 1922, re-establishes the ad valorem duty of 30 per cent on machines for generating electrical current (continuous or alternating), static or rotary transformers and electric motors of less than 20 hp., imported into Portugal.

The duty of 30 per cent ad valorem was levied on all electrical apparatus and machinery until a decree of Nov. 17, 1921, made such articles subject to certain specific duties for a period of five years from Jan. 1, 1921. These specific duties remain unchanged for electrical goods other than those mentioned above.

Chicago Motor Trade Brisk

Reports from four motor manufacturers show that sales in the Chicago territory for October on the small sizes have been good. The market at present on large sizes is limited to central-station developments, which, however, is steady. But the call for motors ranging from 1 hp. to 10 hp. is very active and the distribution is scattered, since motors are going to the pump, printing, elevator and unit-power-driven machine industries.

One firm states that the first ten months of 1922 averaged better than 30 per cent of the business transacted in 1921. For the past month its sales have doubled the sales of October, 1921. This company says that its main volume is going to industrials planning new factory locations and expansions next spring.

Another firm reports an average increase of 25 per cent during the past year. This company says that it has doubled motor sales for the first ten months in 1922 over 1921. Stocks of all manufacturers are in excellent shape, and prices are firm with an upward tendency.

The Metal Market

No Changes of Importance Have Occurred—Export Trade Depressed —Zinc Trading Active

No changes of importance have occurred in the metal market this week, with the exception of a somewhat violent advance in lead. Copper has sold in larger volume, but the demand for zinc and tin has been quiet. Consumption of all metals keeps up wonderfully well, but transportation is not yet adequate to serve the needs of the industry.

There has been more of a tendency to come to the 13.75-cents delivered price than had previously been exhibited, and not more than two or three producers were still adhering to the higher levels previously quoted. Scattering sales were made at premium prices, but they were not a drop in the bucket compared with the large business that was done at 13.75 cents.

The export market was rather depressed during the last week as to volume of sales. Prices netted producers here slightly more than could be obtained for domestic sales. The decline in foreign exchange—in French and German currency in particular—will without doubt have an adverse effect on the ability of European purchasers to buy American copper. The copper industry cannot expand materially until conditions in the export market become more favorable.

Trading in zinc was active during the week at prices slightly under those of the preceding week. The metal is still in a strong statistical position, and the softening in price appears to be a minor reaction and not due to any change in fundamental conditions. One producer was able to obtain 7.10 cents per pound for his zinc without any difficulty, but the largest amount of business was done at the prices we quote. The volume of business in the aggregate was better than last week. Prices are as follows:

NEW YORK METAL MARKET PRICES

	Nov. 9, 1922 Cents per Pound	Nov. 16, 1922 Cents per Pound
Copper		
Prime Lake	13.87½	13.75
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	5.75– 6.25	5.75– 6.25
Brass, light	5.25– 5.50	5.25– 5.50
Lead, heavy	4.62½–4.75	4.62½–4.75
Zinc, old scrap	3.00– 3.37½	3.00– 3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

DECIDED improvement is to be noted in this week's market. Holiday buying is bringing in considerable business, and some jobbers say that the volume of orders will be record-breaking. All sections of New England are responding to the improved conditions in commerce and manufacturing. Deliveries are better. Lamp sales are active with ample stocks and firm prices. A 10 per cent advance on schedule material is reported in the Chicago field. Manufacturers of high-tension equipment report another active business week.

New York

Jobbers Report Fair Demand for Rubber Covered Wire—Replacements Helping Lamp Business

Demand continues to improve with the added interest in holiday buying. Collections are improving and there is renewed activity all along the line. Some buying is being done by the central stations in poles and pole-line hardware in anticipation of winter storms. Heaters and irons are most favored in the appliance market. Conduit stocks cannot be called satisfactory.

Wire.—Jobbers report a fair demand for the rubber-covered. Bare wire for use in radio is improving. Stocks generally are good. Prices are steady.

Lamps.—Lamps for commercial purposes are in steady demand. Stocks are reported ample. Replacements in signs constitute most of the business.

Appliances.—Sales are reported better for this period than for the corresponding week in 1921. High competition prevails in the market.

Fuses.—Jobbers are reporting an improved business with ample stocks.

Flexible Armored Conductor.—Much rewiring is increasing sales of this material. Stocks are fair and prices generally steady.

Motors.—Smaller sizes of motors for the appliance market are being consumed in large numbers. Competition is keen and prices firm.

Chicago

Schedule Material Advances—Lamp Sales Active—High-Tension Demand Brisk

Along with the continuing demand for wiring materials comes a 10 per cent advance in price on schedule material. The conduit supply market is still low and prices are firm. Fall buying of lamps is progressing, according to reports from jobbers. Newly completed buildings require a steady quota of standard fuses and lamps. Manufacturers of high-tension equipment report another active business week.

Wire.—Demand for wire is reported good by jobbers. Stocks are good. Movement of bare wire is hastened by the call for radio aërials.

Conduit.—Very little improvement in the supply situation of conduit is noticed since the building requirements are still active and shipments are sluggish.

Flexible Armored Conductor.—Fall extensions and rewiring are increasing the demand for this material. Stocks are good.

High-Tension Equipment.—Volume of this material is still heavy. One company reports sales on two 600-kva., 13,200-volt outdoor substations for the Middle West and three 1,200-kva., 33,000-volt substations for an oil-refining company in the Southwest. Another firm sold twenty 200-amp., 70,000-volt fuses during the week.

Lamps.—An active fall business is calling for all sizes of lamps, especially in the higher wattages, for use in industrial plants. The railroad buying also is good. Stocks are in good condition.

Fuses.—Jobbers report a brisk call for fuses which they attribute to both the building construction and the normal fall demand by the industrials to rehabilitate their lighting systems. Stocks are good.

Schedule Material.—An advance of about 10 per cent recently went into effect.

Boston

Motors Showing Considerable Life—Lamp Sales Active—Appliance Business Highly Diversified

Gains in trade continue from week to week, all sections of New England responding to improved conditions in commerce and manufacturing. Deliveries are holding their own, on the whole. Unskilled labor is scarcer and price trends are upward for the time being. Weatherprooof wire stiffened last week and rubber-covered wire shows signs of advancing. Building contracts in this section reflect continued improvement, qualified, however, by future price movements. Local stocks are depleted in many lines, but less complaint of shortages is heard, deliveries having noticeably improved at least temporarily. Retail stocks are well prepared for the holiday trade.

Wire.—Weatherproof has advanced to an 18-cent base, in response to upward movements in cotton. Demand is moderate. Stocks are meeting current requirements, which are increasing. Bare wire is very quiet.

Motors. — Sales of direct-current motors for cloth-finishing machine devices, printing-press and envelope machine service demanding variable speeds are showing considerable life. Prices are firm. Stocks of alternating-current motors are rather heavy for the volume of trade now evident and competition is sharp.

Lamps.—Sales are active in various lines, with ample stocks and firm prices. "Blue lamps" for sign service are in greater demand in New England, especially for theatrical work. One large manufacturer has more than 1,500,000 lamps in stock in Boston alone and deliveries are on a very satisfactory basis. Mill-type lamps are in healthy demand.

Sockets.—Trade is active, as in all common lines of wiring supply. Good stocks prevail.

Appliances.—Sales are highly diversified, washers and cleaners showing improvement in response to vigorous retail efforts. Smaller socket devices are moving faster.

Radio Apparatus.—Improved trade is reported, with large stocks and a tendency to unload at cut prices in some retail quarters. One large dealer sold fifteen thousand dollars' worth of sets de luxe at full price during the recent radio show. Interest in parts for amateur assembly is very active.

Atlanta

Hollow-Ware Stocks and Deliveries Are Satisfactory—Large Companies Placing Heavy Pole Orders

Cotton has reached the new high of 26.80 cents, stimulating sales of the staple in the rural districts, which in turn will help collections throughout the territory. Collections up to date have not been all that might be desired. Brisk activity is to be noted in all lines of electric materials, the holiday trade beginning to evidence itself. There is some shortage in conduit and rubber-covered wire, but this is expected to be overcome in the near future. Price advancing is to be noted in some lines.

Hollow-Ware.—More active than for many months past, with evidences of dealers stocking adequately for the holiday demand. Flatirons as usual are leading in popularity. Stocks and deliveries are both satisfactory.

Radio Equipment.—Generally, stocks have been kept in good shape but deliveries are slowing up slightly. One jobber, however, reports only fair sales with good stocks on hand. Prices are steady.

Dry Batteries.—There is a failure to respond to the usual fall activity, though heavy stocks were accumulated in anticipation of a brisk demand. Shipments are satisfactory, with no recent price changes reported.

Poles.—The larger companies have placed some heavy orders recently, but the smaller companies and municipalities are buying rather lightly. Pole-yard stocks are good, with the chestnut

variety the most popular in the small towns and the Western red cedar and creosoted pine leading in the larger centers. Shipments and deliveries good.

Pole-Line Hardware.—Sales are reported brisk throughout the entire line with sufficient stocks on hand. Shipments and deliveries are satisfactory with prices steady.

Cross Arms.—A good movement in this line is reported with the standard arms going to the smaller stations and the N. E. L. A. type to the larger. Continued activity is expected for the next sixty days. Stocks are good, with shipments and deliveries satisfactory.

Refrigerating Equipment.—More activity is being taken on, with an increasing tendency toward the installation of house types of refrigerators in the homes of the well-to-do. No recent price changes are reported.

St. Louis

Cross-Arms Stocks Good—Normal Demand for Insulators—Pole-Line Hardware Slow

Trade for the week showed a tendency toward stiffer prices and consisted of a good volume of small orders. Some deliveries continue slow, but these are principally due to transportation conditions. Power companies are buying reasonably good amounts of pole-line equipment and supplies for seasonal maintenance in preparation for winter storms, but there are no extensive line construction jobs now in progress. Investigations show, however, that a large amount of transmission and distribution work is planned for next year, especially in Missouri and Arkansas.

Cross-Arms.—Local stocks are good with conservative and good shipments.

Insulators.—Normal demand is reported with stocks conservatively maintained and good deliveries obtainable from manufacturers. Prices are firm.

Pole-Line Hardware.—Factory shipments are somewhat slow, and rail conditions further interfere with maintenance of complete stocks. Demand is reasonably active in small orders and users are keeping only minimum stocks.

Cleveland

Smaller Type Motors Active—Prompt Wire Deliveries—Keen Competition in Appliance Market

Electrical business continues to show improvement with brisk movement in all lines. Prices are firm and deliveries good.

Motors.—The smaller type has been active but stocks are good and deliveries prompt.

Radio Equipment.—While no appreciable sales increase is noticeable, business continues in fair volume and indications are that the season will not be a poor one. Stocks are heavy, but demand does not permit over-accumulation.

Wire.—Rubber-covered has been active, but stocks are maintained to standard and deliveries are prompt.

Heaters.—Demand for the small portable type has resumed, and stocks, recently recovered, are beginning to diminish. Deliveries are extended and substantial orders for December delivery are being placed.

Appliances.—Dealers and jobbers report sales to be satisfactory, with especial interest in washers and cleaners. Competition is keen and campaigning evident.

Denver

Good Prospects for Holiday Business—Light Demand for Sewing Machines—Wire Is Steady

A severe touch of winter has slowed business up, especially in new construction work. Weather conditions have not helped freight movements, but jobbers feel that condition of supply will be improved. Prospects for holiday business are good, especially in radio lines.

Pole-Line Hardware.—Stock orders are holding up, but an increase is expected due to breakdowns and repairs necessitated by heavy snow in mountains. Practically no new work or extensions are reported at this time.

Sewing Machines. — Light demand. Department stores and jobbers report ample stocks.

Portable Lamps.—Considerable advertising has increased demand. No unusual sales reported, however.

Wire.—Call on rubber-covered is holding up.

San Francisco

Construction Materials Moving Well—Conduit Boxes Active—Radiators in Strong Position

All construction materials are moving rapidly without serious shortages except for conduit. Much power-line construction and associated building will be released by the result of the state vote on the water and power bill. This proposed constitutional amendment would have authorized the issue of $500,000,000 in bonds for the state purchase of public utilities and have placed practically unrestricted powers in an appointed commission of five men. It was beaten by approximately two to one, the ratio being evenly maintained throughout the state, despite the fact that Los Angeles was cited by the advocates of the bill as a favorable evidence of what the act would do.

Conduit.—There is practically no ½-in. or ¾-in. conduit in the state. Not only are stock orders held up by this shortage, but some dealers have actually found it necessary to take their men off jobs. No immediate relief is in sight.

Boxes and Covers.—Stocks so far are adequate. Factory shipments are fair with some substitutions. No serious shortages will be felt this season despite the steel situation.

Schedule Material.—Stocks are good.

Radiators.—Local manufacturers report a better season than last. Warm weather has continued with no cold spells yet.

Salt Lake City

Lamp Business Reported Brisk—Prices of Heaters Reduced—Vacuum Cleaner Sales Spotty

Bank clearings show steady and substantial gain. Credit is easier and collections are correspondingly improved. Building has slowed up considerably and will probably not resume on a large scale till spring opens. Big improvement projects promise unusual activity for the coming year in Intermountain development. Farmers have more money than for several years, but their relative purchasing power is low, commodity prices tending upward. Sales of electrical merchandise show steady gain in almost all lines.

Lamps.—Business reported brisk from all quarters. Nearly all wattage units in good demand. Stocks are ample.

Heaters.—Recent price cuts from $2 to $3 reported. Standard lines show decreased sales in some cases on account of competition of inferior grades. Jobbers are handicapped for stocks in some instances, factories not having reported on initial orders.

Vacuum Cleaners.—Sales reported good but somewhat spotty. An intensive selling campaign is creating great interest in some cities. Stocks of cleaners and washers are just fair.

Portland-Seattle

Increase of 8 per Cent in Conduit—Improvement in Stocks—Radio Is Better

Lumber production for the Northwest still continues above normal. New business is slightly greater and shipments are less than for the week previous. The car shortage still seriously hampers mills, particularly those off the main lines of the railroad, and stocks are piling up. Following election, building activity is experiencing a slight lull. While temporary conditions are somewhat unfavorable at this time, the total lumber shipments by water from the Pacific Northwest for the first nine months of 1922 were 91 per cent in excess of a similar period in 1921.

Shipments of other commodities also show a very large increase over a year ago, and building activity is at least equal to that af a year ago. Electrical jobbers report business conditions good, with a slight tendency toward easing up. Prices continue to stiffen.

Conduit has increased approximately 8 per cent during the past week. The demand is active for both wire and conduit, particularly of the smaller sizes, and conduit stocks are improving somewhat. Heater stocks are in fair shape and the demand is active. The movement in radio equipment is improving slightly. The demand for all kinds of wire continues good.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Simplex Wire & Cable Branch Established in New York

On Nov. 1 the Simplex Wire & Cable Company, Boston, established a branch office in New York City at 120 West Thirty-second Street, with Joseph G. Brobeck as sales manager. Mr. Brobeck has sold the company's wires and cables in the New York territory since March, 1920, and previous to that time he was connected with the Simplex company's sales organization at Boston during nineteen years.

Black & Decker Manufacturing Moves Philadelphia Branch

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, announces that its branch office and service station at Philadelphia, formerly at 318 North Broad Street, has been moved to 824 North Broad Street. The new quarters are more commodious and modern, according to the announcement.

International G. E. Receives Brazilian Generator Order

The International General Electric Company has received an order for two 25,000-kva. alternating-current generators for installation in the Parahyba station of the Brazilian Hydro-Electric Company.

This station is on the Parahyba River about 100 miles from Rio and will operate in connection with the existing generating and transmission systems of the Rio de Janeiro Tramway, Light & Power Company. Power will be transmitted at 132,000 volts. The ultimate capacity of the station will be approximately 125,000 kva.

Westinghouse Company Establishes New Plant at Seattle

A new plant, which includes an assembling and repair shop, a warehouse and a district sales office, was recently opened in Seattle, Wash., by the Westinghouse Electric & Manufacturing Company. All the activities of the Westinghouse company in the Seattle district are now assembled in one plant, making possible close co-ordination by the sales organization, the service department and the warehouse.

The plant's location along the waterfront district permits the use of a spur railroad track for the loading and unloading of equipment at the warehouse door. The grounds are 300 ft. x 232 ft. and afford ample space for future growth.

The arrangement of the sales office, by which the offices of the district manager and the department heads form a semicircle around the main office, where the general salesmen are, enables a customer to see the representative of any department upon entering the general office and the salesmen within the organization to confer privately with the district manager and the various department heads.

The shop of the service department can be reached from the general office as well as through the warehouse. The service department is divided into four sections, one for repair work, another for assembly work, a third for manufacturing switchboards and a fourth for making coils for the general repair work.

Transfers Appliance and Lamp Business to Addison Electric

Announcement has been made that the good will of the appliance and lamp agency business of the Addison Electric Light & Power Company, Addison, N. Y., has been transferred to the Addison Electric Company. M. G. Hubbs is secretary of the latter company and will take charge of this business in the future.

General Electric Operating at 60 to 65 per Cent Capacity

The General Electric Company, it is announced, is operating at from 60 to 65 per cent of capacity at the present time. It should be borne in mind that this means 60 per cent to 65 per cent of a capacity which has been greatly enlarged over the past few years. The company is now a hundred-thousand-man-power concern, and there are on the payrolls today about 65,000 names.

The peak of incoming orders of the company was reached in 1920, when the sales force booked $318,470,438 of new business. Naturally, the company had to expand physically in order to cope with its filled-up order books. Thus in the following year General Electric owned or had under lease more than 25,000,000 sq.ft. of factory space, which compares with less than 15,000,000 sq.ft. immediately prior to the war and with 7,000,000 sq.ft. in 1908. This increase of plant represented an effort to meet the extraordinary bulge of orders, and as this bulge was in a sense temporary the company elected to lease rather than to build or buy some 1,841,000 sq.ft. of floor space.

In 1921 the company billed $221,000,000 of sales, whereas new business booked during the year was a little less than $180,000,000. This year the tables will be reversed—sales actually billed will be considerably less than bookings.

Johns-Pratt Company Appoints G. Saylor Western Manager

Announcement is made by the Johns-Pratt Company, Hartford, Conn., that it has appointed George Saylor as Western sales manager of its electrical division. Mr. Saylor will make his headquarters at 36 South Desplaines Street, Chicago.

Eureka Vacuum Cleaner Company to Hold $40,000 Selling Drive

The Eureka Vacuum Cleaner Company, Detroit, is setting a forty-thousand-dollar quota in its Christmas selling drive, which begins Nov. 20 and closes Dec. 23.

The company's slogan is, "Eureka vacuum cleaner is the ideal gift." In a bulletin to its sales force the company says:

"Fully 75 per cent of the gifts presented at Christmas are of a practical nature, those to children excepted. Only in the homes of the wealthy few are luxury gifts a custom. But in the homes of moderate incomes—the homes of thrifty, substantial citizens—the homes that just about comprise the entire market—father gives mother at least one thing that will lessen the burden of her daily tasks; mother gives father something that will make him more comfortable, and the children chip in to buy something for their parents of exactly the same nature! Reflect a moment! Among your own friends, isn't this true? Aren't electric appliances, lamps, pieces of furniture, kitchen equipment, auto accessories and the like always under the tree on Christmas morning? Aren't those gifts of an intensely practical nature? Gifts that save labor and give greater comfort because they can be used, instead of merely because they can be looked at."

Galvin Electric Manufacturing Purchases Larger Factory

J. F. Galvin, president of the Galvin Electric Manufacturing Company, St. Louis, announces that his company has purchased a larger factory at 3320 South Broadway in that city and will soon remove to this new location. The Galvin firm is engaged in the manufacture of small motors and radio parts. The new plant affords approximately four times greater floor space.

Mutual Electric & Machine Appoints G. R. Watson to Cincinnati Sales

The Mutual Electric & Machine Company, manufacturer of switches and panelboards, Detroit, announces the appointment of G. R. Watson as district sales manager with headquarters in Cincinnati. Mr. Watson's former connections were with the Pullman Company, headquarters in Chicago; the Crouse-Hinds Company, Syracuse, N. Y., and the Wadsworth Electric Manufacturing Company, Covington, Ky., as general sales manager.

Foreign Trade Notes

PROPOSED ELECTRICAL SYSTEMS IN FRANCE.—A concession has been asked by the Société Hydro-Electrique de la Tardoire for the construction of an electric distributing system to supply electricity in thirteen communes in the Departments of Charente and Dordogne. The Electricité de Strasbourg Company has applied for permission to install an extensive distribution scheme in the country bordering on the Upper and Lower Rhine. Application has been made by the Société Agricole d'Electricité du Canton de la Ferté-Alais for permission to erect a high-tension and low-tension distribution system to serve eighteen communes in the Department of Seine-et-Oise. The Société Co-operative Agricole d'Electricité de Versailles Ouest has petitioned the government for permission to establish a distribution system in the Department of Seine-et-Oise to serve electricity to twelve communes in the Versailles region.

PROPOSED ELECTRIC DISTRIBUTION SYSTEM FOR THE MANAWATU-OROUA DISTRICT, NEW ZEALAND.—The Power Board in the Manawatu-Oroua district (North Island) will soon submit to the ratepayers a proposal to authorize a loan of £500,000 to provide funds for the installation of an electrical distribution system in this district. The project would include about 700 miles of transmission lines, with transformers, equipment, etc.

ELECTRICAL SYSTEM PROPOSED FOR GRAAF-REINET, SOUTH AFRICA.—The municipality of Graaf-Reinet, South Africa, has applied to the provincial government for permission to authorize a loan of £57,000 for various municipal improvements, including the installation of an electric system.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Denmark (No. 4,266) of radio receiving sets and parts and "loud speakers."

Purchase is desired in Spain (No. 4,269) of 60 tons of electrolytic copper wire of high conductibility, 50 sq.mm., in rolls of 250 m. to 300 m.

Purchase and agency is desired in Norway (No. 4,271) of paints, insulating materials, etc.

Purchase is desired in China (No. 4,277) of clay-working machinery suitable for making pottery, fancy tiles, and particularly electric porcelains, and also glazing material of various colors for the above articles.

Purchase and agency is desired in South Africa (No. 4,278) of batteries and magnetos for motor cars, lighting, etc.

Information is desired in Australia (No. 4,302) on electric elevators, high-tension insulators, automatic electric refrigerators for domestic and hotel use, electric kettles, hot plates, toasters, radiators, vacuum cleaners, dishwashers, clothes washers, grillers, irons, floor polishers, ranch-lighting sets, X-ray equipment, radio telephones, radio telegraphs and valves, electrical measuring instruments, burglar-alarm systems, high-tension switches and transformers, light and power machinery such as turbo-generators and hydro-electric machinery, enameled wires and resistance wires for domestic heating apparatus and ventilating plants.

TRANSMISSION LINE TO BE ERECTED FROM HORAHORA TO AUCKLAND, NEW ZEALAND.—Arrangements have been made whereby the Department of Public Works, Auckland, New Zealand, will proceed with the erection of an electric transmission line from Horahora to Auckland.

EXTENSION TO THE AUCKLAND (NEW ZEALAND) TRAMWAY SYSTEM CONTEMPLATED.—Work will be started early in January, 1923, it is stated, on the extension of the Auckland (New Zealand) city tramway service along the Great South Road. The cost, including equipment, is estimated at £75,000.

EQUIPMENT FOR THE MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by R. Liddelow, secretary of the State Electricity Commission of Victoria, Australia, until Jan. 15, 1923, for switchgear and accessories (Specification No. 23/3); also until Jan. 19, 1923, for steam turbine-driven boiler-feed pumps (Specification No. 23/4); also, until Jan. 26, 1923, for high-pressure steam, drain and feed piping, valves, traps, etc. (Specification No. 23/5)—all for the Morwell power scheme.

SWITCHGEAR AND TRANSFORMERS FOR WELLINGTON, NEW ZEALAND.—Tenders will be received by the Public Works Department, Wellington, New Zealand, until Jan. 9 for five sets of 11,000-volt switchgear (substation) and five sets of transformers for the Mangahao power scheme.

TURBO-ALTERNATOR FOR BRIQUETTING WORKS, VICTORIA, AUSTRALIA.—Tenders will be received by R. Liddelow, secretary of the State Electricity Commission of Victoria, Australia, until Jan. 31, 1923, for one 1,500-kw. back-pressure turbo-alternator and accessories for the Yallourn briquetting works, Victoria.

New Apparatus and Publications

ELECTRIC STOVE.—The Gem Manufacturing Company, Detroit, has recently placed on the market an aluminum-electric table stove known as the "Radio."

POWER AMPLIFIER.—The Bristol Company, Waterbury, Conn., is distributing bulletin No. 3,000, describing the "Bristol" one-stage power amplifier recently developed by the company.

OIL PURIFIER.—The Industrial Products Company, Goshen, Ind., is distributing bulletin No. 1,001, covering its "Hydroil" centrifugal oil purifier for purifying liquid lubricants, oils, etc., for use in central stations, refrigerating plants, railroads, etc. This device detects the presence of the slightest particle of water in the oil because of a leak in the cooling coils and removes the water instantly by utilizing centrifugal forces.

SMALL ELECTRIC FURNACES.—The Op-al Electric & Manufacturing Company, Thirty-sixth and Kentucky Avenues, Indianapolis, has brought out a small electric furnace for heating soldering irons, etc.

ELECTRIC CLOTHES WASHER.—The Albaugh-Dover Company, 2100 Marshall Boulevard, Chicago, has recently developed an electrically driven washing machine, "Pal o' Mine," which will be marketed by W. S. Ireland of the same address.

COMBINED PHONOGRAPH AND RADIO RECEIVING SET.—The Serenado Manufacturing Company, Cedar Rapids, Iowa, has recently placed on the market a combination phonograph and radio receiving set.

ELECTRIC BILGE PUMP.—An electric bilge pump has recently been placed on the market by Hubbard H. Erickson & Company, 3,037 North Western Avenue, Chicago.

VACUUM CLEANER.—A new vacuum cleaner, known as the "Duplex," has been brought out by the Electric Vacuum Cleaner Company, Cleveland.

TABLE LAMP RADIO RECEIVER.—The Capitol Phonolier Corporation, 89 Fulton Street, New York City, has placed on the market a combined ornamental table lamp and radio receiving set.

AUTOMATIC WATER SYSTEM.—The Western Pump Company, Davenport, Iowa, is manufacturing an automatic water system, consisting of a pump, motor, automatic electric control switch, etc. These units are made in three sizes, with ½-hp., ¾-hp. and 1-hp. motors.

New Incorporations

THE HOLT (MO.) ELECTRIC LIGHT COMPANY has been incorporated by W. A. McGee, John A. Eby and Myrl M. Johnson. The company is capitalized at $5,000.

THE GATESVILLE (N. C.) LIGHT COMPANY has been chartered with a capital stock of $10,000 by O. C. Turner, C. M. Lawrence and W. J. Davis, all of Gatesville.

THE LINDSAY LIGHT & POWER COMPANY, Mapawa, Wis., has been incorporated with a capital stock of $60,000 by Harold W. Connell, Edward V. Molloy and Herman E. Friedrich.

THE AURORA (WIS.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by P. G. Hovig, Louis Frigo and Carl H. Carlson. The company is capitalized at $3,000 and proposes to supply electricity for light and power in Aurora. Postoffice address is Ironwood, Mich.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTLAND, ME.—The installation of an ornamental lighting system on Baxter Boulevard is under consideration by the Park Commission.

NORTH BILLERICA, MASS.—The Lowell Electric Light Corporation has contracted to supply electricity to operate the new factory of the Talbot Mills. A 13,000-volt transmission line will be erected from its plant in Lowell to furnish the service, which will eventually be extended to Billerica Center. A substation will be installed here.

PAWTUCKET, R. I.—The Phillips Insulated Wire Company is erecting an addition to its power house, to cost about $25,000.

HARTFORD, CONN.—Plans for the new office of the Aetna Life Insurance Company, 650 Main Street, provide for a power house and an electrical department. The cost is estimated at $3,000,000. James G. Rogers, 367 Lexington Avenue, is architect.

STAMFORD, CONN.—The Charles H. Phillips Chemical Company will build a one-story power house at its factory.

Middle Atlantic States

ALDEN, N. Y.—Plans for the proposed new county home to be erected at Alden by the Erie County Board of Supervisors, City Hall, Buffalo, provide for a power house and refrigerating plant. Kidd & Kidd, 234 Delaware Avenue, Buffalo, are architects.

AUBURN, N. Y.—The Firth Carpet Company is preparing plans for a power plant in connection with other extensions to cost $140,000. Lockwood, Greene & Company, 101 Park Avenue, New York, are engineers.

BROOKLYN, N. Y.—The Rubel Coal & Ice Company, Glenmore Avenue, will install electric power equipment, ice and refrigerating machinery at its proposed ice-manufacturing plant at Dahill and Cortelyou Roads, to cost about $200,000.

BUFFALO, N. Y.—The Buffalo Steel Car Company, East Walden Avenue, has completed plans for a one-story power plant at its works, 25 ft. x 100 ft. Plumer & Mann, 700 Main Street, are architects.

LYONS, N. Y.—Preparations are being made by the Empire Gas & Electric Company, Geneva, to enlarge its local plant and to erect a new high-tension transmission line between Lyons and Geneva.

MONTICELLO, N. Y.—Improvements contemplated by the Murray Electric Light Company include overhauling a 33,000-volt line from Cuddebackville to Monticello, 16 miles long, and a 4-mile line from Kiamesha to Monticello; the erection of a 6-mile transmission line from Mongaup Falls to the present line of the Orange County Public Service Company, from near Kiamesha to the Liberty Light & Power Company, and building substations at Monticello, Liberty and Kiamesha.

NEWARK, N. Y.—The installation of a new street-lighting system is under consideration by the Village Board.

NEW YORK, N. Y.—The Solomon Independent Ice Company will install electric power equipment at its proposed 500-ton ice-manufacturing plant, 100 ft. x 150 ft., at East Fifth Street and the East River.

NEW YORK MILLS, N. Y.—The Walcott & Campbell Spinning Company will make extensions and improvements to its power plant to cost about $50,000. The C. B. Roberts Engineering Company, 19 Milk Street, Boston, is engineer.

JERSEY CITY, N. J.—Plans for the proposed new building to be erected at 652-69 Bergen Avenue by the Young Men's Christian Association provide for a power house. The cost is estimated at $500,000. John F. Jackson, 1819 Broadway, New York City, is architect.

MORRISTOWN, N. J.—The Morris & Somerset Electric Light Company will make improvements in the local street-lighting system, including the installation of 600-cp. arc lamps, to replace the 400-cp. lamps now in use. The cost is estimated at about $15,000.

TRENTON, N. J.—Electric power equipment will be installed in the proposed sewerage disposal plant, to cost $1,250,000. The George A. Johnson Company, 150 Nassau Street, New York, is consulting engineer.

ALTOONA, PA.—Plans are being prepared by the Altoona & Logan Valley Electric Railway Company for an addition to its power plant. New equipment, including a generator, condensing engine, surface condenser and auxiliary, apparatus will be installed.

ERIE, PA.—The extension of the ornamental lighting system on State Street from Fourteenth to Thirty-fourth Street is under consideration.

MARCUS HOOK, PA.—The Union Petroleum Company, Widener Building, Philadelphia, will install electric power equipment in connection with additions to its local refining plant, to cost about $500,000.

MIDDLESEX, PA.—The Middlesex Electric Light, Heat & Power Company, recently organized, has made a power contract with the Union Electric Company. A substation will be built at Middlesex and a distributing system erected. C. L. Spahr is secretary. Middlesex has not a postoffice.

NEW BRIGHTON, PA.—Plans are being prepared by the Beaver County Light Company for the erection of a new power house, to cost about $35,000. H. L. Fullerton, 5,444 Kincaid Street, Pittsburgh, is engineer.

PHILADELPHIA, PA.—The L. N. Gilmer Company will build a new power house at its plant at Keystone and Cottman Streets, in connection with a factory addition, to cost about $75,000.

PHILADELPHIA, PA. — Electric power equipment will be installed at the printing plant to be constructed by the Chilton Company at Fifty-sixth and Chestnut Streets, to cost about $200,000. The Ballinger Company, Twelfth and Chestnut Streets, is architect.

PITTSBURGH, PA. — Plans have been prepared by the Franklin Institute, 15 South Seventh Street, for the erection of an electrical laboratory building at Nineteenth and Cherry Streets, to cost with equipment about $250,000.

PITTSBURGH, PA.—A power house will be erected in connection with the proposed new hospital to be erected at the Leech Farms by the Board of Works, to cost about $180,000. J. P. Brennan, Municipal Building, Northside, is architect.

HUNTINGTON, W. VA.—The Huntington Coal & Mining Company will build a power plant at its mining properties and will equip all mines for electrical operation.

WASHINGTON, D. C.—Bids will soon be called by the Bureau of Yards and Docks, Navy Department, for a refrigerating and ice-manufacturing plant at the Pearl Harbor (T. H.) Navy Yard, including power equipment, motor-driven machinery, etc.

North Central States

BATTLE CREEK, MICH.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 4 for conduit and wiring, with lighting fixtures at the local postoffice.

DETROIT, MICH.—The Detroit Edison Company is arranging for a bond issue of $15,000,000, part of the proceeds to be used for extensions and improvements.

DETROIT, MICH.—The Detroit Edison Company is planning to supply electricity in Harsen's and Russell's Island and St. Clair Flats. The cables furnishing the service will be laid under the St. Clair River. The company is also extending its electric lighting system in St. Clair. All outlying districts will be connected with the city street-lighting system.

JACKSON, MICH. — The Riverside Machine Company is preparing plans for a power house in connection with other plant additions.

VANDERBILT, MICH.—The Cheboygan Electric Light & Power Company is planning to furnish electricity for lamps and motors in Vanderbilt.

GALION, OHIO.—Work has started on the construction of the new municipal electric light plant.

OAK HARBOR, OHIO.—The Northwestern Ohio Railway & Power Company contemplates extending its transmission lines to Catawba Island next year.

LEXINGTON, KY.—The Lexington Utilities Company has applied to the County Commissioners for permission to extend its street-lighting service from the city limits at Mentelle Park out on the Richmond Boulevard and beyond Ashland.

SMALLEY, KY.—The Elkhorn Gas Coal Company, Bluefield, W. Va., is considering the electrification of its properties, and will install substation, motors, etc. F. W. Gesling, Ashland, Ky., is consulting engineer.

AUBURN, IND.—Bids will be received by the city of Auburn at the office of G. Potter, city clerk, until Nov. 23 for furnishing and installing equipment and machinery at the municipal water and electric light plant, including three 500-kva. transformers, one generator switchboard panel, one centrifugal pump of 700 gal. per minute capacity and one 75-hp. synchronous motor.

INDIANAPOLIS, IND. — The Indiana Power Company has been granted permission to issue $250,000 in bonds and $92,000 in capital stock, part of the proceeds to be used for extensions and improvements.

LAFAYETTE, IND. — The Council has contracted with the Northern Indiana Gas & Electric Company for electricity to operate the municipal waterworks. The city power plant will be discontinued. Additional electric equipment will be installed at the water plant.

NEW ALBANY, IND.—Steps have been taken by the Chamber of Commerce to establish an ornamental lighting system on three streets in the business section of the city.

BATAVIA, ILL.—The Chicago, Aurora & Elgin Railroad will make extensions and improvements to its local power plant, to cost about $50,000. A transformer station will be erected at Forest Park, to cost $40,000.

SHELBYVILLE, ILL.—Arrangements are being made by the City Council for the construction of a municipal electric light plant, to cost about $100,000.

JANESVILLE, WIS. — The Janesville Electric Company has issued $520,000 in bonds, part of the proceeds to be used for extensions and improvements.

SHOREWOOD, WIS.—The Village Board is considering changing the street-lighting system from gas to electricity. The voters will be asked to authorize an issue of $75,000 in bonds to provide funds for the proposed change. Shorewood has not a postoffice.

PRESTON, IOWA. — The Rural Power Company has applied to the Board of County Supervisors for permission to erect transmission lines along Harrison Street, Green Tree and Bettendorf Roads.

EXCELSIOR SPRINGS, MO.—The North Missouri Power Company, recently organized, has purchased the Excelsior Springs (Mo.) Water, Gas & Electric Company, the Edina (Mo.) Light Company, the Merchants' Light & Power Company at Novinger and the Brookfield (Mo.) Electric Light Company. Application has been made to the State Public Service Commission to merge the properties under the name of the North Missouri Power Company. The company is to be capitalized at $1,500,000.

FAUCETT, MO.—The Board of Directors of the consolidated school district No. 3 is planning to build an electric light and power plant in connection with an extension to the local school building.

FULTON, MO.—Bids will be received by the Council until Nov. 22 for a municipal electric lighting plant, to cost about $35,000. Hugo K. Graf, Chemical Building, St. Louis, is architect.

HOLT, MO. — The Holt Electric Light Company, recently organized, plans to operate a local system. W. A. McGee heads the company.

RICH HILL, MO.—The City Council has engaged Arthur L. Mullergren, Kansas City, Mo., consulting engineer, to prepare plans for improvements to the municipal electric light plant.

REYNOLDS, NEB.—The Councils of Reynolds and Gilead have approved plans for the construction of a joint transmission line to Fairbury to furnish electricity for light and power service in both towns.

SUMNER, NEB.—The Councils at Sumner, Miller and Eddyville have contracted with the United Electric Company, Lexington, for local service. A transmission line will be operated from Lexington.

KINSLEY, KAN. — The Public Utilities Commission has granted the Pawnee Power & Water Company, Larned, permission to increase its capital stock, the proceeds to be used for the purchase of the municipal electric light plant.

LEAVENWORTH, KAN.—Bids will be received by the Board of Education until Nov. 21 for a power house, to be used in connection with two grade school buildings, to be built at the same time. Charles A. Smith, 602 Finance Building, Kansas City, Mo., is architect.

Southern States

ASHEVILLE, N. C.—The Carolina-Tennessee Power Company contemplates the construction of two dams on the Hiwassee River, to develop 30,000 hp. E. B. Norvell, Murphy, is secretary.

KINSTON, N. C.—The Kennedy Memorial Home will build a transmission line, about 5 miles long, from the city to the home site, for local service.

STATESVILLE, N. C.—J. C. Steele & Sons, manufacturers of machinery, are planning to install electrical equipment, including a generator, motors, etc.

WHITEVILLE, N. C.—Plans are under way for a municipal electric power plant and waterworks system, the latter to include an electrically operated pumping station.

WILMINGTON, N. C. — The Broadfoot Iron Works will install electric power equipment, including a traveling crane, in connection with plant additions, now in course of construction.

SAVANNAH, GA.—Plans are under consideration by the Dunlevi Lumber Company for the erection of new mills, with power plant and machine shop, to increase its capacity to 50,000,000 ft. per year.

JACKSONVILLE, FLA.—The Board of Electric Light Commissioners is considering extensions to the municipal electric light plant involving an expenditure of about $500,000. The work will include an addition to the main power plant, the installation of a 12,500-kw. turbo-generator, improvements to all substations and placing high-tension lines underground from the main plant on Talleyrand Avenue to substation at Main and First Streets. The Scofield Engineering Company, Philadelphia, is consulting engineer.

STARKE, FLA.—Bonds to the amount of $36,000 have been authorized for extensions to the electric light and water systems.

TALLAHASSEE, FLA.—An election will be held Nov. 21 to vote on the proposal to issue $145,000 in bonds for extensions to the electric light and sewerage systems.

FLORENCE, ALA.—The Council is considering calling an election to submit to the voters the proposal to build a municipal hydro-electric plant on Cyprus Creek, to develop from 200 hp. to 500 hp.

SMACKOVER, ARK.—Arrangements have been made with the Arkansas Light & Power Company for the installation of a local power plant, to cost about $25,000.

SPRINGDALE, ARK.—The Welch Grape Juice Company, Westfield, N. Y., will build a power house in connection with its proposed local plant, to cost about $300,000.

NEW ORLEANS, LA.—The Cloverland Dairy Company will install electrical equipment in connection with a new refrigerating plant and other improvements, to cost about $200,000.

MUSKOGEE, OKLA.—The Oklahoma Gas & Electric Company, Oklahoma City, contemplates increasing the initial capacity of its electric power plant on the Arkansas River, east of Muskogee, from 10,000 hp. to 30,000 hp. The cost of the plant is estimated at about $3,000,000.

DALLAS, TEX. — The Stickle Lumber Corporation, Maple Avenue, is considering the construction of a new mill and power house, to cost about $80,000. R. O. Jameson, American National Bank Building, is consulting engineer.

McLEAN, TEX.—Work will soon begin on the construction of the municipal electric light plant. Funds to the amount of $30,000 are available.

SHERMAN, TEX. — Plans have been completed for extensions to the lighting system in the Greenmount and Christian College districts.

Pacific and Mountain States

OKANOGAN, WASH.—Application has been made to the County Commissioners by the United States Reclamation Service for permission to erect electric transmission lines along the roads of the main lateral of the Okanogan Irrigation District to the upper main lateral.

SEATTLE, WASH. — The Council has appropriated $60,000 for the installation of a 15,000-volt circuit for the municipal light and power system.

SPOKANE, WASH.—The Boundary Red Mountain Mining Company plans to triple the present output of its power plant.

VANCOUVER, WASH.—Plans are being considered by Beers & Bennett, Vancouver, for the construction of a lumber mill, in-

cluding a power plant, on the Nehalem River, near St. Helens, Ore., to be equipped for a daily capacity of 20,000 ft.

WALLA WALLA, WASH.—Preparations are being made by the Pacific Power & Light Company to rebuild the flume to the Walla Walla River plant, at a cost of about $79,000.

CANBY, ORE.—Owing to the failure of the Mollala Electric Company to meet the terms offered by the city for its plant, the City Council has made arrangements to install a new electric lighting and power plant independent of the present system.

MEDFORD, ORE. — The California & Oregon Power Company has applied for permission to erect three hydro-electric power plants, with capacities of 9,000 to 15,000 and 20,400 hp. respectively, in the vicinity of Bradley Falls and Ireland Falls.

PORTLAND, ORE.—The Lincoln County Light & Power Company, recently organized, plans to install a system in a section of Lincoln County. The company is headed by H. A. Holland and Maurice W. Seitz, both of Portland.

PORTLAND, ORE. — The Northwestern Electric Company is completing plans for an addition to its steam-driven generating plant at the foot of Lincoln Street, to cost about $500,000. New transmission and distributing lines will be built to cost $400,000.

BAKERSFIELD, CAL.—Bids will be received by the Board of County Supervisors until Dec. 18 for electric work, refrigerating plant and other electrical and mechanical installations in the proposed County Hospital group, Flower Street, East Bakersfield. Charles H. Bigger, Bank of Italy Building, Bakersfield, is architect. F. E. Smith is clerk.

DINUBA, CAL.—The Central California Ice Company, Fresno, will install electric power equipment at its proposed ice-manufacturing plant at South M and Ventura Streets, to have a capacity of 30 tons daily.

FRESNO, CAL.—The Fresno Paper Company will install electric power equipment at its proposed paper-boxboard mill, to cost about $500,000.

SAN FRANCISCO, CAL.—The Board of Supervisors is arranging a fund of $10,000 for the installation of a street-lighting system on Valencia Street from Market to Twenty-eighth Street.

VISALIA, CAL.—The Chamber of Commerce is perfecting plans for the installation of an ornamental lighting system in the business section, covering nine city blocks.

WILMINGTON, CAL.—The Pacific Coast Borax Company, Oakland, will take bids early in January for a factory and power plant in the local harbor district, to cost about $1,000,000. Albert C. Martin, Higgins Building, Los Angeles, is architect.

COEUR D'ALENE, IDAHO.—The Home Builder Mining & Development Company, Spokane, Wash., has applied for permission to construct hydro-electric power plants in Phanton and Blue Grouse Creeks, with initial capacity of about 250 hp.

ST. GEORGE, UTAH.—The Public Utilities Commission has granted the Dixie Power Company permission to extend its transmission lines to Summit.

Canada

WANETA, B. C. — The Waneta Power Company contemplates the contsruction of diversion dam, 40 ft. high, 75 ft. wide, 115 ft. head to develop 4,000 hp., in connection with a hydro-electric development in 1923. The cost is estimated at $3,000,000. E. K. Scot, Waneta, is engineer.

ST. JOHN, N. B.—Electric power equipment will be installed by the Stephen Brick Company, Ltd., in connection with the proposed rebuilding of its local plant, recently destroyed by fire, causing a loss of about $100,000.

GUELPH, ONT.—The fire, light and water committee of the City Council have recommended that a bylaw authorizing an expenditure of $550,000 for a new fire hall, fire-alarm system and triple combination engine be submitted to the ratepayers.

NORTH BAY, ONT.—A report has been submitted to Premier Drury by G. Lee, chairman of the Temiskaming & Northern Ontario Railway Company, recommending the electrification of 253 miles of main line and 40 miles of branch lines. The cost, including trolley line, transmission lines, substations, locomotives and possibly hydro-electric generating stations, is estimated at about $9,000,000. S. B. Clement, North Bay, is chief engineer.

TORONTO, ONT.—The erection of a one-story automobile and truck building, machinery, etc., at Exhibition Park is under consideration by the Canadian National Exhibition, King Street East.

Electrical Patents

Announced by U. S. Patent Office

(Issue Oct. 24, 1922)

1,432,938. BATTERY SEPARATOR; W. H. Wood, South Euclid, and H. E. Smith, Cleveland, Ohio. App. filed Feb. 9, 1920. Flexible insoluble reinforcing fibers and flexible, porous, wick-forming fibers combined together.

1,432,939. SEPARATOR FOR STORAGE BATTERIES; W. H. Wood, Cleveland, Ohio. App. filed April 17, 1920. Fabric made of rubber composition traversed by strands of mamalian hair.

1,432,965. ELECTRIC CIRCUITS; W. L. Casper, Brooklyn, N. Y. App. filed Sept. 3, 1919. Filters employed to limit the frequency range.

1,432,978. PRINTING TELEGRAPH SYSTEM; A. D. Dowd, Hoboken, N. J. App. filed April 17, 1918. Combined perforator and transmitter.

1,432,989. ELECTROMAGNETIC CLOCK; M. P. Favre-Bulle, Boulogne, and M. A. Moulin (deceased), Besancon, France. App. filed Aug. 23, 1920. Mechanical device for actuating hands and electromagnetic device for maintaining oscillations of pendulum.

1,432,992. VACUUM-TUBE SOCKET; J. O. Gargan, Brooklyn, N. Y. App. filed Sept. 5, 1918. Resilient holder for carrying tubes.

1,433,017. ELECTRODE; R. H. McKee, New York, N. Y. App. filed Nov. 5, 1920. Electrode for electrolytic cells with conductive base and adherent, acid-resisting coating.

1,433,037. MOTOR; C. H. Reid, Somerset, West South Africa. App. filed Nov. 26, 1918. Packing-gland construction for direct-connected pump used to pump acids or alkalis.

1,433,055. COMBINED STEAMER, STILL AND BURNER FOR BATTERY REPAIRING; E. R. Williams, Springfield, Mo. App. filed July 15, 1922. Apparatus for cleaning, repairing and building storage batteries.

1,433,061. ELECTRIC FLATIRON; E. S. Avery and O. O. Fusch, San José, Calif. App. filed July 22, 1920. Automatic cut-out when temperature reaches predetermined limit.

1,433,070. METHOD AND APPARATUS FOR DETERMINING THE ACTUAL LOCATION AND ACTUAL MOVEMENT OF BODIES; W. W. Conners, Elizabeth, N. J. App. filed June 6, 1918. Ascertains position of receiving station with respect of plurality of transmitting stations emitting radiant energy.

1,433,073. THERMOSTAT FOR SEARCHLIGHTS; A. P. Davis, New York, N. Y. App. filed April 13, 1916. Automatic means for maintaining arc in focus of projector.

1,433,078. ELECTRIC INDICATING DEVICE; F. Hülss, Halensee, Germany. App. filed Oct. 19, 1920. Indicates condition of discharge in submarine batteries.

1,433,089. THREE-PHASE DRIVING SYSTEM FOR MARINE PROPELLERS; W. Mollier, Vienna, Austria. App. filed Jan. 7, 1921. Generators and motors of two frequencies used.

1,433,136. ELECTRIC BATTERY; F. M. Holmes, Wichita Falls, Tex. App. filed June 19, 1922. Composition of active material for primary and secondary batteries.

1,433,155. ELECTRIC INSTALLATION; M. Schenkel, Charlottenburg, Germany. App. filed Dec. 4, 1920. Control apparatus for mercury-vapor rectifier.

1,433,184. ELECTRIC MASSAGE APPARATUS; H. Csanyi, New York, N. Y. App. filed June 24, 1921. Induction coil, interrupter and battery mounted in flashlight casing.

1,433,224. VARIABLE CONDENSER; J. Parkin, Jr., San Rafael, Calif. App. filed March 29, 1920. Stationary mercury plate and rotatable plate.

1,433,264. ELECTRICAL TESTING INSTRUMENT; H. Fahlenberg, Pankow, near Berlin, Germany. App. filed Oct. 2, 1919. For locating faulty circuits.

1,433,286. PHYSICIAN'S HEATING APPLIANCE; R. M. Kannenstine, Chicago, Ill. App. filed Nov. 1, 1920. For physicians use in applying heat to interior parts of body.

1,433,298. TELEPHONE SWITCHING APPARATUS; L. Polinkowsky, Antwerp, Belgium. App. filed Nov. 11, 1919. Method of testing and seizing connecting circuits of selective switches.

1,433,305. LOADED TELEPHONE-LINE SYSTEM; T. Shaw, Hackensack, N. J., and William Fondiller, New York, N. Y. App. filed July 16, 1918. Loading coils and amplifying apparatus comprise an artificial line for balancing line.

1,433,311. SIGNAL DEVICE; J. E. Sumpter, St. Paul, Minn. App. filed Dec. 21, 1917. Semaphore arm operated by electromagnet.

1,433,331. DEVICE FOR TRANSMITTING ELECTRIC CURRENT BETWEEN ROTATING AND NON-ROTATING MEMBERS; H. K. Angstrom, Malmo, Sweden. App. filed March 12, 1921. Applied to journal and journal box of electric cars.

1,433,358. MEANS FOR WARMING THE RADIATORS OF MOTOR CARS; P. Elphick, Balcombe, England. App. filed April 26, 1921. Electric heating element to prevent freezing of water in radiators and water jackets of motor cars.

1,433,388. WATER HEATER; R. G. Ledig, Philadelphia, Pa. App. filed March 24, 1922. Water completes circuit of heating element.

1,433,397. ELECTRIC CONNECTOR; A. Meyer, New York, N. Y. App. filed Dec. 26, 1919. Connector for single-wire circuit.

1,433,403. PROCESS OF MAKING FERRO-URANIUM; F. F. Mueller and R. W. Harris, Washington, Pa. App. filed Oct. 20, 1920. By reducing uranium oxide in electric furnace.

1,433,404. ELECTRIC FURNACE; F. F. Mueller and R. W. Harris, Washington, Pa. App. filed Oct. 20, 1920. Ferro-uranium furnace lining of uranium oxide combined with binder.

1,433,448. ELECTRIC FURNACE; T. S. Curtis, Providence, R. I. App. filed Aug. 7, 1920. Apparatus for treating magnesite and other ores for highly refractory material.

1,433,455. BATTERY-CHARGING APPARATUS; A. J. Horton, White Plains, N. Y. App. filed Feb. 25, 1918. Charging rack for portable batteries comprising a metallic skeleton frame.

1,433,464. DENTAL RADIOGRAPH DEVICE; C. A. LeMaster, St. Louis, Mo. App. filed March 17, 1921. Film holder with radiolucent abutment determining bearing plane.

1,433,465. ELECTRIC HEATER; E. N. Lightfoot, New York, N. Y. App. filed July 29, 1920. Resistor element wound around core wire having insulating covering.

1,433,472. ELECTRIC HEATER; R. J. Patterson, Boston, Mass. App. filed Nov. 21, 1921. Electric water heaters of immersion type.

1,433,488. TESTING DEVICE; G. E. Smith, New York, N. Y. App. filed May 9, 1919. Portable apparatus adapted for testing motor-vehicle accessories.

1,433,492. TROLLEY CATCHER; P. N. Van Epp, Cleveland, Ohio. App. filed Feb. 2, 1922. Spring-actuated rope-winding reel.

(Issued Oct. 31, 1922)

1,433,526. DRY CELL; R. C. Benner and H. F. French, Fremont, Ohio. App. filed Nov. 14, 1918. Suitable for heavy current drains.

1,433,541. METHOD OF EXTRACTION OF METALS FROM THEIR COMPOUNDS; P. Freedman, London, and E. Greetham, Hull, England. App. filed April 10, 1922. By reduction in an evacuated electric furnace.

1,433,542. COVER CONSTRUCTION FOR STORAGE BATTERIES; W. Gardiner, Chicago, Ill. App. filed March 28, 1921. Evaporation of electrolyte reduced.

1,433,543. ELECTRICAL COMBINATION LOCK; L. Garrison, Salt Lake City, Utah. App. filed Sept. 20, 1920. Combination lock for safes, vaults, houses, etc.

1,433,568. ALUMINUM BODY FOR MAGNETIC CHUCKS; F. L. Simmons, Woonsocket, R. I. App. filed Feb. 26, 1918. Housing and support for pole pieces made from non-magnetic material.

1,433,570. BATTERY HAND LAMP; F. G. Stimson, New Haven, Conn. App. filed Oct. 20, 1921. Variable focus.

1,433,578. ELECTRIC TRANSFORMER; E. Vedovelli, Paris, France. App. filed March 30, 1921. High-voltage transformer.

1,433,594. TELEPHONE EXCHANGE SYSTEM; R. S. Bailey, Montclair, N. J. App. filed Jan. 7, 1920. Cord circuit for private branches arranged for through supervision.

1,433,597. DYNAMO-ELECTRIC DIRECT-CURRENT GENERATOR; R. Boin, Argenteuil, France. App. filed Oct. 4, 1918. Variable air gap.

1,433,599. RADIO CIRCUIT; R. Bown, East Orange, N. J. App. filed July 2, 1921. Sends and receives simultaneously.

1,433,600. CLAMPING MECHANISM; W. M. Brown and H. F. A. Kleinschmidt, Johnstown, Pa. App. filed Feb. 11, 1921. To force track rails together for electrically butt-welding.

1,433,602. BATTERY ELEMENT AND PROCESS OF FORMING THE SAME; A. Cellino, Buenos Aires, Argentina. App. filed June 15, 1916. Battery element of immunized zinc.